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GLOBAL MARKET SURVEY

Export Opportunities for

ELECTRONICS INDUSTRY PRODUCTION AND TEST EQUIPMENT

U.S. DEPARTMENT OF COMMERCE / Domestic and International Business Administration

This Global Market Survey is one in a series of publications focusing on overseas marketing opportunities for U.S. suppliers in selected industries. These Surveys are prepared by the Office of International Marketing and are based on research conducted in key foreign markets

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ELECTRONICS INDUSTRY PRODUCTION AND TEST EQUIPMENT

U.S. DEPARTMENT OF COMMERCE
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Preface

This Global Market Survey is an export sales planning tool for marketing decision makers of U.S. firms that manufacture production and test equipment for the electronics industries. It is both a ready reference of facts and figures on the foreign electronics industries and a guide to profitable growth opportunities through exports. This Survey contains a series of reports based on market research conducted in 24 countries for the Office of International Marketing of the Department of Commerce. They are intended to aid company executives in planning exports of U.S. production and test equipment to overseas electronics industries.

Department of Commerce account executives in 43 district offices stand ready to assist U.S. firms in the development of export marketing plans tailored to the specific needs and capabilities of the individual company. This is an important phase of a continuing Commerce Department trade promotion program aimed at establishing growth in exports for individual sectors of U.S. industry. U.S. products and industries selected for a Global Market Survey are generally in areas where the United States has technological or other competitive advantages in the foreign marketplace.

Global Market Surveys already published or scheduled for publication in the current year include:

- Agricultural Machinery and Equipment (1973)
- Micrographics Equipment and Supplies (1973)
- Biomedical Equipment (1973)
- Computers and Related Equipment (1973)
- Materials Handling Equipment (1974)
- Electronics Industry Production and Test Equipment (1974)
- Printing and Graphic Arts Equipment (1974)
- Electronic Components (1974)
- Metalworking and Finishing Equipment (1974)

Additional information on this Survey or any of the above Global Market Surveys and associated industry programs may be obtained by contacting the Domestic Field Programs Division, Office of Export Development, Bureau of International Commerce, U.S. Department of Commerce, Washington, D.C. 20230, or any one of the Department of Commerce District Offices listed on page 133 of this publication.

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Major Foreign Markets

Expanding world demand for consumer, commercial, and industrial electronics products will cause substantial growth in the market for production and test equipment within the foreign electronics industries during the 1970's. Total consumption in 18 leading countries[1] is expected to more than double during the 1972-77 period, rising from $445 million in 1972 to an estimated $1.13 billion in 1977.

U.S. manufacturers are by far the dominant world suppliers of electronics production and test equipment. In the 15 countries for which a market share breakdown was provided, U.S. makers in 1972 supplied a total of $155 million worth of equipment, or more than 37% of total market demand (see Table 1). Trade experts predict that U.S. exports will account for more than 50% of consumption within these countries by 1977, reaching a level in excess of $500 million.

The findings presented in this survey are results of research conducted for the Commerce Department's Office of International Marketing in 24 country markets. Basic research for the "Country Market Surveys" section was performed in selected countries either by experienced overseas market research companies or the Department's own market research officers. The "Country Market Briefs," with one exception, are based on reports from the respective U.S. Foreign Service Post. The Market Brief on Yugoslavia was prepared on the basis of research within the Department of Commerce.

The countries covered in the Survey were selected after consultation with a cross-section of U.S. electronics industry production and test equipment manufacturers. The following types of markets were included:

- *The largest country markets*—e.g., Japan, Germany, France, United Kingdom
- *Smaller country markets with high growth potential*—e.g., Korea and India
- *Four Eastern European markets*—Hungary, Poland, Bulgaria and Romania
- *Country markets with mostly foreign-owned electronics firms*—e.g., Ireland, Portugal, Singapore, Hong Kong.

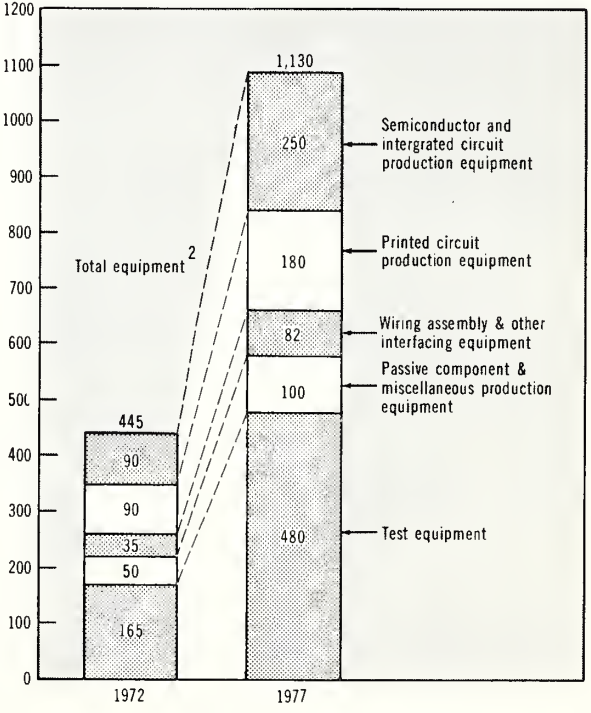
Outlook Bright for U.S. Equipment Sales

Opportunities for increased sales of U.S.-made electronics industry production and test (EIPT) equipment to manufacturers in all surveyed countries are considered excellent. Although virtually all types of American-made equipment likely will find profitable growth markets overseas, some items have been singled out by foreign end-users as having potential for exceptionally high demand during the next 5 years. The boxed list on page 3 shows products with the highest sales potential selected from the 24 individual surveys.

PRODUCTION EQUIPMENT. Consumption of electronics industry production equipment in 18 major foreign markets totaled $275 million in 1972 and an estimated $365 million in 1973. The market is expected to expand at an average rate of 18% a

**Consumption of Electronics Industry Production and Test (EIPT) Equipment in 18 Countries[1/]
1972 and projected 1977**

(in millions of U.S. dollars)



1/ Australia, Belgium, Bulgaria, France, Germany(West), Hong Kong, Hungary, Israel, Italy, Japan, Korea, Netherlands, Poland, Singapore, Taiwan, Sweden, Switzerland, United Kingdom.

2/ Total greater than sum of sub-categories since only total consumption estimates were available for Bulgaria.

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[1] Australia, Belgium, Bulgaria, France, West Germany, Hong Kong, Hungary, Israel, Italy, Japan, Korea, Netherlands, Poland, Singapore, Sweden, Switzerland, Taiwan, United Kingdom.

year and to reach at least $630 million in 1977. The total 1972 U.S. share of 15 of these markets for which information was available (see Table 1 for deletions) was over 30%, or $80 million. U.S. exports are expected to grow at an average annual rate of 25% and to reach $250 million, or 45% of total consumption, by 1977. This projected growth is attributed mostly to the planned expansion of production facilities to meet the increasing demand for electronics products in all economic sectors. One of the fastest growing country markets for production equipment is Hungary. This market is growing at an estimated rate of over 65% a year, due to the added impetus of Government programs initiated to expand the country's electronics industry. Manufacturers in most countries are seeking to increase the productivity of their plants to counter rising labor costs. For this reason, U.S. firms are in an excellent position to take advantage of the market for increasingly advanced and specialized equipment designed to automate production processes.

Semiconductor and integrated circuit production equipment sales were estimated at $90 million in 1972 and are expected to reach $137 million in 1977. The market for this type of equipment is the largest and fastest growing, based on a predicted average annual expansion rate of 23%. The projected market value of this subcategory should reach $250 million in 1977. The demand for semiconductors and integrated circuits is rising rapidly. Factors in this demand are the development of expanded and automated telecommunication and transportation systems, and the increased application of computers in government and business. Added to these factors is the growing demand for such consumer products as color TV receivers and home audio equipment.

The market for printed circuit (PC) production equipment is greatest in Western Europe, particularly France and Germany, where increasing demand for consumer electronics and telecommunications equipment is necessitating stepped-up production of printed circuit boards. Rising labor costs in the major Far East markets are forcing manufacturers in that area to shift to automated PC production equipment. Other producers, such as those in Israel, are taking steps to cut production costs by replacing obsolete equipment. Printed circuit production equipment sales in the surveyed countries were $90 million in 1972 and are expected to more than double by 1977.

Sales of wiring assembly and other interfacing equipment reached an estimated $35 million in 1972 and are expected to exceed $82 million in 1977. An average annual growth rate of 18% is forecast over the 1972-77 period, spurred primarily by the recognized need to replace manual wiring methods with automated machinery. There is a particularly high demand for such equipment in Germany, where the market is expected to rise from $6 million in 1972 to about $24 million in 1977.

Passive component and miscellaneous production equipment sales in the major foreign markets were over $50 million in 1972 and reached an estimated $67 million in 1973. Sales are expected to increase almost 15% a year, climbing to approximately $100 million in 1977.

TEST EQUIPMENT. Growth in test equipment sales is expected to average about 25% annually between 1972 and 1977, with the market in 18 countries expanding from approximately $165 million in 1972 to over $480 million in 1977. The U.S. share of the 15 markets for which data could be obtained (see Table 1 for deletions) has been over 45%. It is expected to reach 60% in 1977. In the largest markets—Germany, Japan, and France—the U.S. share should be even greater, approaching 65%. U.S. sales should grow an estimated 27% a year, rising from over $70 million in 1972 to $235 million in 1977. The demand for test equipment is spurred by the need to assure production of reliable components for increasingly advanced computers and other highly developed electronic products. Countries that are manufacturing components and end-products primarily for export, such as Israel and those in the Far East, are finding it necessary to invest in new test equipment to ensure that their products meet the stringent requirements of overseas customers.

The Electronics Industries

Growth of foreign EIPT equipment markets will depend on the ability of overseas electronics industries

Table 1.—Consumption of Electronics Industry Production and Test Equipment and U.S. Share of Market, by country,[1] 1972 and projected 1977.
(in millions of U.S. dollars)

	1972		1977	
	Total Consumption	U.S. Market Share	Total Consumption	U.S. Market Share
Germany	107.1	42.2	343	187.0
Japan	97.4	41.9	213	112.0
France	70.0	25.4	150	80.0
United Kingdom	38.1	7.8	56	10.5
Korea	16.0	3.4	58	15.0
Italy	15.6	6.1	35	19.0
Switzerland	15.0	6.0	25	9.0
Hong Kong	10.4	1.3	18	5.0
Israel	9.9	7.3	19	13.0
Australia	8.0	1.9	12	4.5
Netherlands	7.0	3.6	10	5.0
Singapore	6.9	3.3	12	4.5
Sweden	5.8	1.1	15	3.0
Belgium	4.8	2.2	7	3.5
Hungary	3.8	2.2	53	30.0
TOTAL	415.8	155.7	1,028	501.0

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[1] Comparable figures were not available for Brazil, Bulgaria, India, Ireland, Poland, Portugal, Romania, Taiwan and Yugoslavia.

Electronics Industry Production and Test Equipment with Best Sales Prospects for U.S. Suppliers

SEMICONDUCTOR & INTEGRATED CIRCUIT PRODUCTION EQUIPMENT

Conveyor, diffusion & firing furnaces
Ion implantation equipment
Diamond & laser scribing machines
Thermocompression & ultrasonic bonders
Soldering equipment
Thick-thin film resistor trimmers

WIRING ASSEMBLY & OTHER INTERFACING EQUIPMENT

Point-to-point wiring equipment
Color-coding machines
Crimping machines
Wire cutters & strippers
Terminal installing machines
Connector assembly machines

PRINTED CIRCUIT PRODUCTION EQUIPMENT

Cleaning & drying equipment
Photo-printers
Drilling machines
Component inserting & sequencing machines
Silk screen equipment
Protective coating equipment

PASSIVE COMPONENT & MISCELLANEOUS PRODUCTION EQUIPMENT

Molding presses
Riveting machines
Micromaterials handling & positioning machines
Labeling machines
Coil winders

TEST EQUIPMENT

Integrated circuit test equipment
Transistor test equipment
Diode test and classifier equipment
Resistor test equipment
Wiring test equipment
Printed circuit board testers
Environmental test chambers
Chip evaluation equipment
Digital systems analyzers
Wafer probing equipment
Wire bond testers

to maintain the production increases they experienced in the late 1960's and early 1970's. Although electronics production levels of even the major overseas countries have been dwarfed by the output of the U.S. electronics industry (see Table 2), trade experts predict that foreign production will accelerate much faster than that in the United States during the remainder of the decade.

The following summaries, by geographic regions, provide a glimpse of what is to be expected in the way of a foreign customer base for U.S.-made EIPT equipment.

THE FAR EAST. The electronics industries of the Far East[2] are becoming increasingly diverse and sophisticated, generally reflecting the needs of their primary customers in Europe and the United States. Electronics production in the region was estimated at over $12 billion in 1972. Trade sources within the major markets anticipate the area's production to grow at an average annual rate of 20%, reaching a yearly level of approximately $30 billion in 1977. While Japan dominates the regional electronics industry (it manufactured over 80% of the area's output in 1972), Taiwan, Singapore, Korea, and Hong Kong are expected to expand their production capacity and increase their output at a greater rate than their industrialized neighbor. Both Singapore and Korea anticipate expansion at average annual rates of at least 40% during 1972-77. This will result in 1977 production levels of $1.4 and $1.1 billion, respectively. Taiwan's output is expected to grow by 25 to 30% annually, rising from about $486 million in 1972 to approximately $1.5 billion in 1977. Hong Kong is expected to increase its production base from $346 million (1972) to approximately $900 million in 1977, a better than 20% average annual growth rate.

In terms of total number of firms, the region has about 2,850 electronics companies, 65% of which are located in Japan. Japan's percentage share is expected, however, to decline over the next 4 years. Korea is actively pursuing a policy of increasing the number of its electronics firms from the 288 registered in 1972 to over 700 in 1980. Singapore also expects a substantial increase in its production base as more foreign corporations set up operations there.

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[2] Includes only those countries covered in this Survey: Hong Kong, Japan, Korea, Singapore and Taiwan.

Table 2.—Estimated production values of world's major electronics industries, 1972.

(in billions of U.S. dollars)

	All electronics products	Electronic components
United States	28.1	5.7
Japan	9.6	3.8
Germany	6.3	1.1
United Kingdom	3.2 [1]	.7
France	2.9	.8

[1] Total for 1971 only.

In addition, Taiwan and Hong Kong are attracting considerable attention from foreign manufacturers as rapidly rising wage rates begin to affect Japan's industry.

The major markets in the Far East are export oriented. Taiwan, Hong Kong, and Singapore each export approximately 90% of their domestic production and are expected to continue to rely heavily on export proceeds to support their domestic industry. Increases in exports during the period 1974-77 are expected to vary greatly from country to country. Japan, for example, anticipates that exports will play a lesser role during the 1973-77 period. Foreign demand for Japanese-built TV's, tape recorders, and radios is expected to level off, while local demand for electronic products, especially components and industrial items, should increase sharply. Korea, on the other hand, plans to export 80% of its electronics production by 1980, a significant gain from the 68% recorded in 1972.

- Production of *electronic components* in the five surveyed countries is expected to increase from a base of $3.4 billion in 1972 to over $9.5 billion in 1977, a 24% annual increase. The phenomenal demand for pocket-size calculators, the rising demand for computers, and the anticipated adoption of integrated circuits to wristwatches and automotive equipment are the primary justifications for the projected rise in production. Although Japanese component manufacturers are expressing concern over labor shortages, their 1977 production should climb to $7.7 billion, almost double the estimated 1973 level of $4 billion. Korea expects domestic manufacture of electronic components to exceed $650 million in 1977, reflecting a 40% annual increase over the $127 million level recorded in 1972.
- Production of *consumer electronic products* in the Far East was valued at almost $5 billion in 1972. Principal items manufactured were television receivers, transistor radios, and tape recorders. TV's, particularly color receivers, should continue to experience an increase in sales volume, although at a slightly slower rate than has been recorded in the recent past. This is based on the belief of local sources that the TV market will reach near-saturation within the next 3 to 5 years. The advent of electronic watches and the increasing demand for tape recorders, radios, and stereo sets should boost sales of consumer products to $9.3 billion in 1977. This would reflect a 13% average annual growth rate for the area.
- Production of *commercial and industrial electronic goods* in the Far East is expected to increase 25% yearly, climbing from the 1972 base of $3.5 billion to $11 billion in 1977. Taiwan, which manufactured approximately $200 million of industrial electronic products in 1972, expects its output to exceed $600 million in 1977. The figure probably will go higher if foreign companies set up local telecommunications production facilities, as anticipated. Domestic and global demand is expected to increase Japan's output of industrial electronic products during the 1972-77 period from $3.3 billion to over $9.8 billion.

WESTERN EUROPE. The combined production of electronics industries in the 10 Western European countries surveyed[3] should grow at an average annual rate of 10.6% during the next 5 years. Total output is expected to rise from $15.6 billion in 1972 to nearly $26 billion in 1977.

Germany leads the area by a wide margin, with industry output valued at $6.3 billion in 1972. Its production is expected to grow at an average rate of 9.6% annually through 1977. The French industry, third largest, with an output of $2.9 billion in 1972, should show the greatest growth. The French Government has set a goal for production increases in the industry averaging 17% annually during the Sixth Plan (1971-75). This rate is expected to be maintained at least through 1977. Ireland and Portugal, with young industries supported by low-cost labor, are expected to attain average annual production increases of approximately 15% through 1977.

- A worldwide shortage of *electronic components* is spurring sharp increases in European components output as producers aim to provide a greater share of the growing requirements of the area's electronic end-product manufacturers. Many component manufacturers in France, for example, have begun large-scale modernization programs in order to mass-produce components for domestic EDP equipment and consumer electronics manufacturers. French firms' expansion programs are also directed toward increasing output of MOS and ECL integrated circuits needed by domestic telecommunications equipment producers. These modernization and expansion plans are expected to boost French components production from $772 million in 1972 to $1.2 billion in 1977, an average annual gain of almost 10%. Germany's output of components is forecast to rise faster than 12% per year during this period, from $1.1 billion to $2 billion. Trade sources also predict average annual production increases during the next 5 years of almost 7% in Sweden, 10% in Switzerland, and 23% in Ireland.

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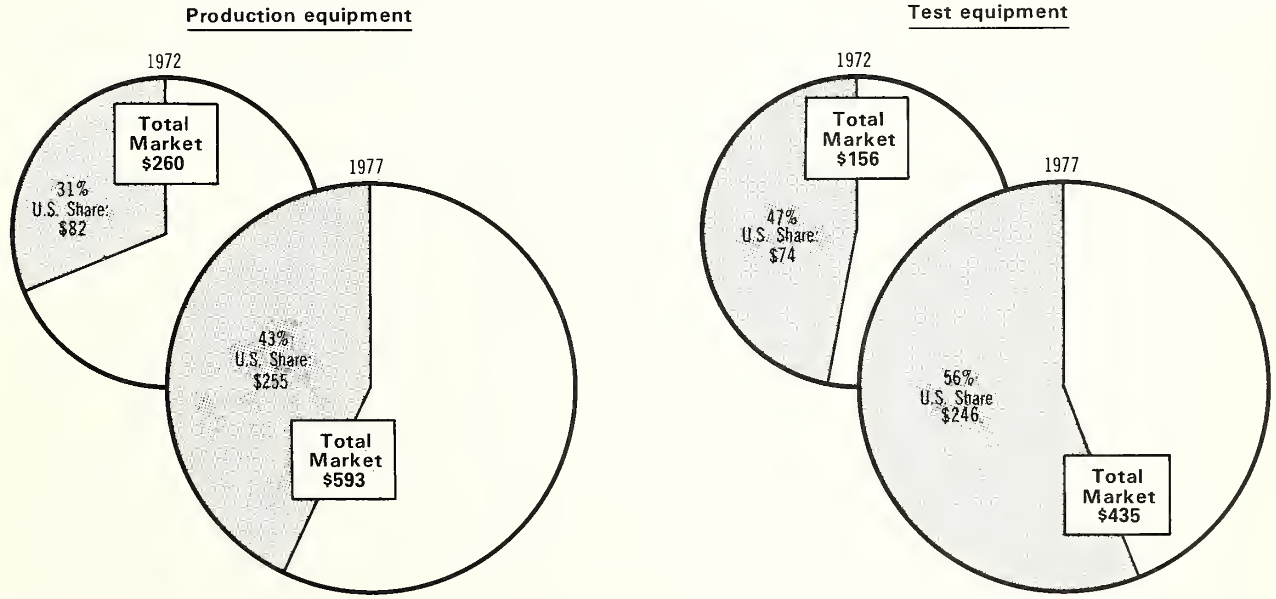
[3] Belgium, France, West Germany; Ireland, Italy, The Netherlands, Portugal, Sweden, Switzerland, and the United Kingdom.

European output of finished electronic products is expected to grow rapidly through 1977. The greatest growth is expected in the production of color television receivers, computers, and communications equipment. French production of electronic end-products is projected to climb nearly 20% annually, from $2.1 billion in 1972 to over $5 billion in 1977. German output during this period should rise 9% per year—from $5.2 billion to $8 billion.

- In *consumer electronics,* the greatest emphasis will be placed on expanding production of color television receivers. French output of color TV's, estimated at 560,000 units in 1973, is expected to reach 790,000 units in 1975. Germany's output was estimated at 2 million units in 1973 and is projected at 2.4 million units in 1974. Growing demand in the United Kingdom, where sales of color sets rose from $450 million (1.3 million units) in 1972 to an estimated $700-$950 million in 1973, has spurred British manufacturers to expand production.
- Government incentives are encouraging many European firms to increase *computer* production. For example, the German Government is expected to nearly double its allocation for EDP research and development from $175 million in 1973 to $321 million in 1975. Computer production in Germany is expected to reach $3.6 billion annually by 1978, to double the 1973 level. Under the French Government's Plan Calcul to strengthen the domestic computer industry, French-owned companies are subsidized through government grants and preferential purchasing policies. French computer manufacturers as a result are expanding production, investing heavily in product development, and engaging in joint research and manufacturing ventures with major foreign computer manufacturers.
- European governments are also playing a major role in stimulating local production increases of *electronic communications equipment.* For example, Belgium's continuing modernization of its telephone system is expected to contribute to annual increases of 15% in domestic produc-

U.S. Share of the Electronics Industry Production and Test Equipment Market in 15 Countries[1], 1972 and projected 1977.

(in millions of U.S. dollars)



[1] Australia, Belgium, France, Germany(West), Hong Kong, Hungary, Israel, Italy, Japan, Korea, Netherlands, Singapore, Sweden, Switzerland, United Kingdom.

tion of electronic telecommunications equipment. The Federal Postal Authority's plan to progressively change the electromechanical telephone system to an electronic system is the major factor underlying projected increases in German production of electronic communications equipment. Output is forecast to rise at an average rate of 25% annually, climbing from $893 million in 1973 to $2 billion in 1977. Telecommunications equipment manufacturers in France have undertaken or are planning large-scale programs to modernize and expand their production facilities as a result of anticipated high levels of Government spending within the sector. Improved telecommunications facilities, including the development of an electronic switching system, is one of the Sixth Plan's priority considerations.

EASTERN EUROPE. The decade of the 1970's promises to be an impressive growth era for the electronics industries of most Eastern European countries. Total preoccupation with the growth of heavy industries is a thing of the past in these nations. They are now placing greater emphasis on the development of industries that require increasingly higher levels of technological know-how. The major target of attention will be electronics. This industry's growth is planned to result in the ultimate adoption by Eastern Europeans of Western-style consumerism with its heavy reliance on electronics. Another goal is the formation of viable and strongly export-oriented industries.

Four countries included in this survey (Bulgaria, Hungary, Poland, and Romania) provided a cross-section of developed and developing Eastern European countries. The five-year plans (1971-75) of all four place heavy emphasis on electronics industry development and recognize the need for substantial imports of Western equipment and technology so as to achieve planned objectives.

- The Polish electronics industry, for example, is slated for rapidly rising levels of output. Value of production, estimated at $1 billion in 1972, is expected to exceed $1.7 billion in 1975. Some key product areas designated for production expansion include: Transistors, from 14.7 million units in 1972 to 28 million in 1975; color TV receivers, from nil to 60,000 units; tape recorders and dictaphones, from 550,000 to 750,000 units; and transistor radios, from 5,000 to 1 million units. In addition, the industry is gearing up to make a strong showing in the computer markets of Poland and other Eastern European countries.
- Hungary's plans for its electronics industry also go far beyond the satisfaction of domestic demand. Exports of the industry were estimated at $107 million in 1972, with expectations they will reach $250 million in 1977. Telecommunications equipment currently heads the list of exported electronics products, but trade experts feel that other industrial and consumer electronic products also will show strong gains in the coming years. For example, annual production of television receivers and tape recorders is expected to double between 1972 and 1977.

Selling in Eastern Europe—Some Unique Features

Several important factors must be taken into account by U.S. exporters in transacting business with Eastern European buyers. Key considerations, include:

- *Government agencies.* **Although most of these countries implemented some liberalizing economic reform schemes during the late 1960's and early 1970's, they still must be considered as heavily centralized. This means that a potential exporter cannot deal exclusively, or even directly, with the end-user of equipment. In most cases, initial contact and finalization of a transaction must be made through the appropriate Foreign Trade Organization (FTO). An FTO is an export-import agency for either a particular set of products or for all products that a particular industry buys and sells.**
- *Centralized industries.* **Industrial production in Eastern Europe is centrally organized and administered by ministries, such as the Ministry of the Electronics Industry or the Ministry of the Chemical Industry. The ministries, in turn, have jurisdiction over several "trusts" or "combines" that have a monopoly over the production of a large variety of goods in the industry, e.g. UNITRA of Poland or Resprom of Bulgaria. The trusts control and operate actual production plants and, in some cases, also have their own R&D and marketing organizations.**
- *Currency.* **The currencies of all Eastern European countries are "soft," i.e., not readily convertible into western currencies. Transactions with western suppliers therefore often take the form of some type of barter arrangement or are based on switch financing. However, since most five-year plans have designated the electronics industry as a priority sector, central planners are more likely to allocate the necessary amounts of "hard currency" (reserves of western foreign exchange) for the purchase of equipment by that industry.**
- *Obtaining permission to export.* **Some U.S. products are embargoed to certain Eastern European countries because of their strategic military significance. Some types of semiconductor and integrated circuit production and test equipment, for example, fall into that category. Details regarding the affected products and destination countries may be obtained from the Office of Export Administration, Bureau of East-West Trade, U.S. Department of Commerce, Washington, D.C. 20230.**

Country Market Surveys

Surveys on 14 primary country markets for electronics industry production and test (EIPT) equipment are contained in this section. These surveys are based on comprehensive on-site market studies conducted for the U.S. Department of Commerce in the respective countries.

The *Country Market Surveys* emphasize product areas in the market for EIPT equipment, as follows:

- Semiconductor and integrated circuit production equipment
- Printed circuit production equipment
- Wiring assembly and other interfacing equipment
- Passive component and miscellaneous production equipment
- Test equipment for production/inspection of electronic products

Market Size

- Narrative and statistical presentation of size of market for EIPT equipment, historical and projected growth, imports, and the U.S. share of market.

Specific Sales Opportunities

- Listing and brief discussion of items within the above mentioned product area that are expected to hold attractive growth potential for U.S. manufacturers.

End-User Analysis

- Discussion of most active market sectors, including potential growth areas of each.
- Profiles of typical users of EIPT equipment in the market sectors.

Competitive Environment

- Position of domestic EIPT equipment industry
- Foreign competition in market
- U.S. position
- Inhibiting factors (duties, trade regulations, etc.)

Technical Requirements

- Electrical power, voltage and frequency
- Technical standards and requirements where applicable.

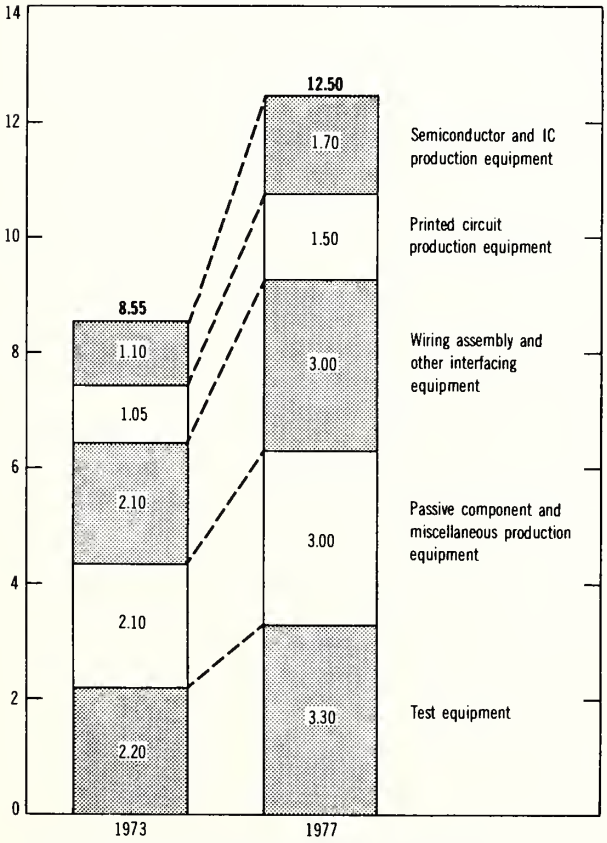
Australia

Australia's electronics industry, spurred by Government policies aimed at expanding the industry and encouraging greater use of locally made components in its products, is expected to increase its expenditures for production and test equipment at an average annual rate of 10% during the next 4 years.

The Australian market for electronics industry production and test (EIPT) equipment, estimated at $8.55 million in 1973 (see table 1), should top $12 million in 1977.

Australia: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Australian trade source estimates.

A continued high level of Government spending for telecommunications equipment and a sharp rise in domestic demand for consumer electronics products are contributing to an optimistic outlook for Australia's electronics industry and are creating increased EIPT equipment requirements.

The advent of color television transmission in Australia, scheduled for September 1975, should have a strong bearing on the industry's future. To ensure that they can supply a significant share of Australia's color TV market, domestic electronics manufacturers have applied for high protective tariffs on finished television sets and components. If these tariffs are granted, component and receiver manufacturers are expected to spend at least $10 million in late 1973 and in 1974 to expand their production facilities in order to meet the anticipated demand for color television sets.

These expansion efforts should include substantial allocations for EIPT equipment and could well result in annual increases in equipment expenditures markedly higher than the anticipated 10%.

Approximately 45% of Australia's EIPT equipment requirements in 1972 were met by imports, principally from the United States. U.S. suppliers sold about $1.9 million worth of EIPT equipment in Australia in 1972, representing a 24% share of the total market in that year. Sales by all other foreign suppliers were estimated at $1.7 million, a market share of 21%.

EIPT equipment manufactured by domestic electronics firms for in-house use represented 30% ($2.4 million) of the 1972 Australian market. Domestic EIPT equipment manufacturers, with 1972

Australia—Selected Indicators (1972)

Gross national product:	$42.2 billion (FY 1972)
Population:	13 million
Total country imports:	$4.6 billion
Total country exports:	$6.5 billion
Exchange rate (October 1973):	0.67 Australian dollars=US$1

sales in Australia valued at $2 million, held a 25% market share.

Most EIPT equipment manufactured in Australia is relatively unsophisticated. Australia's electronics industry, anxious to keep pace with changing technology but unable to support the research and development efforts needed for domestic production of specialized and advanced EIPT equipment, can be expected to increase its EIPT equipment imports during the 1974-77 period.

U.S. suppliers, acknowledged by Australian users to have the most technologically advanced equipment available, should benefit greatly from the growing Australian reliance on imports. Sales of U.S.-made EIPT equipment in Australia are forecast to reach $4.5 million in 1977, for a projected market share of 36%. Equally beneficial to the future of U.S. sales is the favorable import climate in Australia created by the January 1973 revaluation of the Australian dollar and the recent devaluation of the U.S. dollar.

Selected Sales Opportunities

A market research survey recently conducted in Australia for the Office of International Marketing, U.S. Department of Commerce, indicates favorable sales opportunities for U.S. manufacturers of the following EIPT equipment:

Semiconductor and Integrated Circuit Production Equipment
- Substrate preparation equipment
- Integrated circuit bonding equipment

Printed Circuit Production Equipment
- Drilling machines
- Component inserting and sequencing machines
- Multiple slotting machines

Wiring Assembly and Other Interfacing Equipment
- Automatic welding systems
- Color-coding machines
- Crimping machines
- Cutters
- Strippers
- Terminal-installing machines
- Connector assembly machines

Passive Component and Miscellaneous Production Equipment
- Micromaterials handling and positioning equipment
- Labeling machines

Test Equipment for Production/Inspection of Electronic Products
- Integrated circuit test equipment
- Transistor test equipment
- Printed circuit board testers
- Environmental test chambers
- Digital systems analyzers

Production equipment.—Australian purchases of production equipment are expected to grow at an average annual rate of 9.7% during the 1973-77 period, totaling over $9 million in the latter year. This represents a substantial rise from the 1971-73 period, when purchases increased 5.4% annually, going from $5.72 million to $6.35 million.

American manufacturers of advanced production equipment should find a receptive market for their products among Australia's large electronics firms. Recent wage increases in the electronics industry, notably in the communications sector, have stimulated management interest in the use of automated equipment and systems to reduce production costs. Anticipated expansion in the volume and range of components produced in Australia makes the use of automated equipment economically justifiable for many firms.

U.S. suppliers should also find a ready market for specialized production equipment that is not produced domestically or is produced only on a limited scale, particularly equipment used to manufacture semiconductors and printed circuit boards.

Australia's market for semiconductor and integrated circuit production equipment increased 10% between 1971 and 1973, climbing from $1 million to $1.1 million. With a 55% increase expected between 1973 and 1977, the market should total $1.7

Table 1.—Australia: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment....	1.00	1.00	1.10
Printed circuit production equipment	1.00	1.00	1.05
Wiring assembly and other interfacing equipment	1.82	2.00	2.10
Passive component and miscellaneous production equipment..	1.90	2.00	2.10
Test equipment for production/inspection of electronic products	1.82	2.00	2.20
Total	7.54	8.00	8.55

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Australian trade source estimates.

million in the latter year. U.S.-made substrate preparation equipment is considered by Australian end-users to be technologically superior and more competitively priced than that of other foreign suppliers. Projected growth in component assembly in Australia should result in strong sales for U.S. manufacturers of integrated circuit bonding equipment.

The growing use of printed circuits by Australia's professional and consumer electronics manufacturers and telecommunications equipment manufacturers is expected to generate an average annual growth of 9.5% between 1973 and 1977 in sales of printed circuit production equipment. The market for this equipment, which stood at $1 million in 1971 and was estimated at $1.05 million in 1973, should reach $1.5 million in 1977.

U.S.-made component inserting and sequencing machines, favored by the Australian electronics industry for their technological superiority, are expected to be used increasingly in modular assembly operations. U.S. suppliers also should be able to capitalize on the growing needs of large electronics manufacturers for multiple slotting machines and high-speed precision drilling equipment used in the production of custom-built printed circuit boards. Neither type of equipment is currently produced in Australia.

Australia's telecommunications equipment manufacturers, responding to a growing demand for their products, increased their expenditures for wiring assembly and other interfacing equipment from $1.8 million in 1971 to $2.1 million in 1973. Purchases in 1977 are expected to total $3 million, an increase of 65% over the 1971 level.

The strong demand for crimpers, cutters, strippers, and color-coding machines by firms manufacturing equipment for Australia's extensive telephone network should ensure substantial sales by U.S. suppliers of these products in spite of local and foreign competition. The expanding operations of firms which specialize in the manufacture of connectors, such as Australian AMP Pty., Ltd., will result in an increasing demand for automated connector assembly machines. Several of these manufacturers are subsidiaries of U.S. firms and have an expressed preference for competitively priced equipment of U.S. origin.

Expenditures for passive component and miscellaneous production equipment, estimated at $1.9 million in 1971 and $2.1 million in 1973, are forecast to grow 9.2% annually between 1973 and 1977, reaching $3 million in the latter year. Advanced technology should give U.S. firms a competitive edge in Australia's now limited but developing market for micromaterials handling and positioning equipment. An increase in the demand for labeling machines, resulting from the growth of component manufacture and assembly in Australia, also warrants attention from U.S. suppliers.

Australia's Electronics Industry—Basic Data (1972)

Number of manufacturers:	**246**
Sales of selected industry sectors:*	
Electronic components—	**$37 million**
Electronic consumer products—	**$184 million**
Communications equipment—	**$392 million**
Output of selected products:	
Transistors —	**$9.4 million**
Television receivers—	**$77 million**
Radio receivers—	**$52 million**

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* Sales by members of leading electronics manufacturers' associations.

Test equipment.—The Australian market for test equipment was estimated at $1.8 million in 1971 and $2.2 million in 1973. The country's test equipment requirements are expected to increase by an average of 10.6% per year during the 1973-77 period, with the market seen to exceed $3 million in 1977.

The Australian Government's Postmaster-General Department, one of the electronics industry's primary customers because of its administration of the country's sophisticated telecommunications network, has set high standards for testing throughout the industry. Almost all leading Australian electronics firms use advanced test equipment at every step in the manufacturing process, and automated systems are used widely for simultaneous testing of a large volume of components.

U.S. manufacturers of test equipment, who now satisfy half of Australia's requirements, can look forward to increased sales during the next several years. U.S.-made transistor test equipment, integrated circuit test equipment, printed circuit board testers, and environmental test chambers will continue to have high sales potential in Australia. The increased use of digital systems by Australian firms has created outstanding sales opportunities for U.S. manufacturers of digital systems analyzers.

The Electronics Industry

Australia's electronics industry, though small by world standards, is well established and technologically advanced. The industry credits its ability to satisfy strong domestic demands for high-quality components, consumer electronic products, and telecommunications equipment to imported technology backed by a skilled labor force. Faced with rapidly rising wages and anticipating heavy production demands, the industry can be expected to increase its use of advanced EIPT equipment during the next several years to achieve more cost-effective production.

Industry production diversified.—The Australian electronics industry includes approximately 250 firms. A recent publication of the Australian Department of Trade provides a breakdown of these firms by eight major product groups (see table 2).

The industry's strength lies in its manufacture of components, consumer products, and telecommunications equipment. The output of firms in these industry sectors totaled $613 million in 1971. Sales of telecommunications equipment accounted for $392 million of this total; the sales value of consumer products was estimated at $184 million and components at $37 million. Employment by these sectors in 1971 totaled 35,000, as follows: telecommunications, 20,000; components, 9,000; and consumer, 6,000.

Industry statistics show that between 1971 and 1973 there were increases estimated at 44% in the quantity of transistors produced in Australia and 37.5% in that of radio receivers (see table 3). A decline in Australian demand for television sets since the late 1960's was reflected in a more modest increase of 8.6% in Australian production of TV receivers during the 1971-73 period.

Foreign interests strong.—Approximately 80% of the total output of Australia's electronics industry is accounted for by seven large manufacturing groups: Amalgamated Wireless Australasia (AWA), Ltd.; EMI Australia, Ltd.; Hawker Siddeley Electronics Pty., Ltd.; Philips Industries, Ltd.; Plessey Pacific Pty., Ltd.; Siemens Industries, Ltd.; and Standard Telephone and Cables (STC) Pty., Ltd.

Four of these companies are wholly owned by overseas parent firms: Hawker Siddeley and Plessey are subsidiaries of British firms; Siemens of Germany controls Siemens Industries; and the ITT Corporation of the United States controls STC. Only AWA is wholly Australian owned, and there is some Australian equity in the British subsidiary EMI and the Dutch-owned Philips.

Table 2.—Australia: Electronics manufacturers, by percent group

Product group	Number of firms[1]
Measurement and test instruments	102
Industrial and process control equipment	86
Telecommunications equipment	76
Components	66
Consumer electronic products	36
Data processing equipment	26
Defense electronic products	21
Electromedical instruments	16

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[1] Duplication occurs in the figures since most companies specialize in more than one category.

Source: *The Australian Electronic Manufacturing Industry.*

Table 3.—Australia: Output of transistors, TV and radio receivers, 1971-73

	1971		1972		1973	
	No.[1]	Value[2]	No.	Value	No.	Value
Transistors	16.0	7.4	19.0	9.4	23.0	10.2
TV receivers	.2	74.0	.2	77.0	.2	79.0
Radio receivers	.8	45.0	.9	52.0	1.1	62.0

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[1] Numbers in millions.

[2] Values in millions of U.S. dollars.

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study.

Protective barriers on component imports have contributed to a high degree of vertical integration of products manufactured in several of Australia's major electronics firms. Philips produces a wide range of semiconductors and other components through its subsidiary Hendron S.A. Philips is also one of the industry's leaders in the manufacture of telecommunications equipment and (through its subsidiaries Pye Industries Pty., Ltd., and Kriesler Australasia, Ltd.) in consumer products.

AWA likewise produces components, telecommunications equipment, and consumer electronic products through various manufacturing divisions. Plessey Ducon Pty., Ltd., is a leading component manufacturer, while Plessey Telecommunications is one of Australia's top four suppliers of equipment for the country's communications network. STC, which is one of Australia's major manufacturers of semiconductors, is also an industry leader in the production of professional electronic products.

Subsidiaries of European (particularly British) firms dominate the telecommunications, component, and consumer segment of Australia's electronics industry, while subsidiaries of U.S. firms are the country's primary manufacturers of electromedical apparatus, data processing equipment, and process control and test instrumentation.

Leaders in the latter industry segments include subsidiaries of ITT; Honeywell, Inc.; AMP, Inc.; and the Texas Instruments Co. Fairchild Australia Pty., Ltd., a subsidiary of the U.S. firm Fairchild Camera and Instrument Corporation, commands a strong share of Australia's components market despite strong competition from AWA, Philips, and Plessey.

Government policies strengthen industry outlook.—Protective trade policies of the Australian Government provided the initial impetus for the development of an electronics industry in Australia. The Government has contributed to the industry's growth during the past 25 years through purchasing practices, research efforts, and financial assistance programs. Industry expansion plans are tied closely to Government actions regarding offset spending, communications equipment purchasing, and tariffs.

The Australian Industrial Research and Development Grants Board has provided $8 million in financial assistance since 1967 to firms manufacturing electronic and electrical equipment, including AWA, Plessey, and the telecommunications equipment manufacturer L. M. Ericsson Pty., Ltd. In addition, the Government maintains electronics research facilities through the Commonwealth Scientific and Industrial Research Organization and the Department of Supply.

The efforts of the Department of Supply emphasize effective microelectronics design and production and are aimed at "the development and manufacture of modules and equipment to a standard comparable with that obtained overseas." Specific research programs of the Department have included the study of computer-aided circuit analysis and synthesis, a review of circuits in weapons systems, the manufacture of ceramic power electron tubes, and the manufacture of monolithic crystal filters.

The Department of Supply also administers a Government policy of offsets between foreign suppliers of military hardware and electronic equipment and the domestic electronics industry. This policy, which requires that foreign suppliers to the Government either carry out their work in Australia or subcontract a percentage of the work to domestic companies, has resulted in domestic electronics firms receiving orders totaling $51 million in recent years.

The policy has also contributed to an increased domestic capability in military electronics and in aircraft manufacturing and assembly. The Department's offset spending in fiscal 1972 totaled $288 million. Spending increases of between 10 and 15% per year are expected during the next several years.

The Postmaster-General's Department, which oversees Australia's telecommunications network, has also assisted industry development. The Department's policy of buying Australian-made products whenever possible, initiated in the late 1940's, led to rapid expansion in the industry's manufacture of components, telephone equipment, and sophisticated telecommunications equipment. As of June 1972, the agency had an estimated investment of more than $3.6 billion in telecommunications equipment.

The Post Office recently announced plans to double its telecommunications investment during the next 5 years, assuring its suppliers of an even stronger market than in the past.

The epansion plans of consumer electronics firms depend to a great extent on the outcome of a current inquiry by the Australian Tariff Board into electrical and electronic manufacturing. The inauguration of color television transmission in Australia, planned for September 1975, is expected to spark a domestic demand for color television that may reach 490,000 sets during the first 2 years of transmission.

To ensure that Australian manufacturers realize a significant share of this market, the electronics industry has applied for high protective tariffs on the import of both finished sets and components. These tariffs are being given priority consideration by the Tariff Board as part of its current inquiry. Should the protective tariffs be granted, component and receiver manufacturers will have to expand their production facilities in 1974 to be ready to meet the 1975 Australian demand. Expansion costs are estimated at a minimum of $10 million for the 1973-74 period.

Competitive Environment

Domestic suppliers held a slight edge over foreign suppliers in satisfying Australia's EIPT equipment requirements in 1972 (see table 4). The major portion of Australian demand for conventional production equipment is met by local EIPT equipment manufacturers and by local electronics firms producing equipment for in-house use.

Foreign suppliers, principally from the United States, satisfy 75% of Australia's test equipment requirements and all of its requirements for advanced production equipment.

Most of Australia's major electronics firms have in-house capabilities for producing relatively unsophisticated EIPT equipment to meet their specific manufacturing requirements. Production equipment manufactured by domestic electronics firms in 1972 for their own use was valued at $2.1 million and represented 35% of Australia's production equipment market. Test equipment produced by these firms in 1972 was valued at $300,000 and represented a 15% share of the test equipment market.

The Australian Government indirectly supports domestic manufacturers of EIPT equipment by allowing purchasers an income tax deduction of 20% of the price of equipment produced domestically. Backed by this support, Australian manufacturers of EIPT equipment realized a 30% share of the domestic production equipment market in 1972, with

Table 4.—Australia: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	2.1	.3	2.4
by other firms	1.8	.2	2.0
Imported:			
from the U.S.	.9	1.0	1.9
from other countries	1.2	.5	1.7
Total	6.0	2.0	8.0

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Australian trade source estimates.

sales of $1.8 million. The $200,000 worth of test equipment sold by local firms in 1972 represented 10% of the country's market for this product subcategory.

Of Australia's 11 major manufacturers of EIPT equipment, William Adams & Co., Ltd., is the only supplier of ultrasonic bonding equipment. Royston Electronics Pty., Ltd., a leading manufacturer of microjointing, welding, and soldering equipment, also makes printed circuit production equipment. Other domestic manufacturers of printed circuit production equipment include Tucker Industries Pty., Ltd.; Hanimex Pty., Ltd., which produces photoprinters; Lawrence, Smith and Cumming Pty., Ltd., which produces electroplating equipment; and McPhersons, Ltd., which produces routers.

Australian AMP Pty., a subsidiary of the U.S. firm AMP, Inc., is Australia's top supplier of wire stripping machines and wiring tools, and Marfleet & Weight Manufacturing Pty., Ltd., is the major supplier of molding presses. Three companies, Camelec, Ltd., Precision Engineering Pty., Ltd., and Smiths Industries Pty., Ltd., produce test equipment and are also prominent component manufacturers.

U.S. leads foreign competition.—The United States is Australia's major supplier of test equipment and the leading foreign supplier of automated production equipment. U.S. firms supplied 50%, or $1 milion worth, of the test equipment purchased in Australia in 1972. Sales of $900,000 of production equipment by U.S. firms in 1972 represented 15% of the production equipment market.

The United States is expected to steadily advance its position in Australia's EIPT equipment market during the 1974-77 period (see table 5). Increased Australian interest in the laborsaving advantages and high capacity of American-made production equipment should result in sales of over $2.5 million by U.S. firms in 1977, pushing the U.S. share of Australia's production equipment market to almost 28%. Industry sources estimate that the U.S. share of Australia's test equipment market will be 60% in 1977, with sales projected to total almost $2 million.

Several subsidiaries of U.S. firms (including ITT, Honeywell, AMP, Fairchild, and Texas Instruments) manufacture EIPT equipment in Australia. Although most of the equipment produced by these firms is for their own use, some is also being supplied to the Australian and third-country markets. As noted earlier, Australia AMP Pty., Ltd., which manufactures edge connectors for printed circuit boards, supplies the domestic market with wiring assembly equipment. Fairchild, Australia's major semiconductor manufacturer, has recently received a substantial order for test equipment from a leading Asian electronics company.

Table 5.—Australia: Imports from the U.S. of electronics industry production and test equipment, 1972 and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	0.90	1.22	2.53
Test equipment	1.00	1.33	1.97
Total	1.90	2.55	4.50

Source: U.S Department of Commerce, Bureau of International Commerce market research study. Values based on Australian trade source estimates.

As a result of its development of Australia's private automatic branch exchange, Pentaconta PABX, STC became the world PABX research center for ITT. This has resulted in the export of substantial amounts of telecommunications equipment by STC, and trade sources indicate that STC's exports may include EIPT equipment within the next 5 years.

Australian EIPT equipment imports from countries other than the United States, principally Japan, the Netherlands, and the United Kingdom, totaled $1.7 million in 1972. In that year, third-country suppliers sold production equipment valued at $1.2 million and test equipment valued at $500,000, realizing 20% and 25% shares, respectively, of these markets. British firms selling EIPT equipment in Australia include Barclay & Partners, Ferranti, Ltd., and the Marconi Company, Ltd. One of the Japanese firms active in the market is the Toyo Communications Equipment Company, Ltd.

Tariff policies support imports.—While duties on EIPT equipment imported into Australia range from 20 to 35%, a bylaw provision of the Australian tariff system permits the duty-free entry of any equipment that is not produced domestically. Because Australia's domestic production of EIPT equipment is limited in terms of equipment types, a substantial amount of EIPT equipment enters the country duty-free.

Preferential duties are levied on imports from the United Kingdom, Canada, New Zealand, Papua, and New Guinea. It is expected that the preferential system will be discontinued, however, because of the United Kingdom's membership in the European Economic Community. Additional information concerning import duties and regulations may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Room 4219, Main Commerce Building, Washington, D.C. 20230.

Most purchases of EIPT equipment by Australian end-users are financed through Australian trading banks and merchant banking organizations via letters of credit and overdraft facilities. Financing also can be arranged through the Export-Import Bank of the United States or, for Australian subsidiaries of overseas parent organizations, through intercompany borrowing arrangements.

During the past 5 years, a lease-back arrangement between an equipment purchaser and a bank or financial institution has been initiated in Australia for major equipment purchases.

Independent suppliers wishing to market their EIPT equipment in Australia are advised to tailor their sales efforts to the small size of the Australian market. Most independent suppliers are represented in Australia through distributors. It is important to select a distributorship that has a sales and service office in Adelaide, where there is a concentration of electronics manufacturers, as well as in Sydney and Melbourne.

Technical Requirements

Electricity in Australia is generally supplied at 240 volts and 50 hertz. The Australian system of weights and measures is based on the Imperial system, but the metric system is widely used and should be in full operation by 1980. Further information on technical requirements in Australia may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

The following market research study is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M Main Commerce Building, Washington, D.C. 20230:

"The Market for Electronics Industry Production and Test Equipment in Australia," DIB 73-12-506, May 1973.

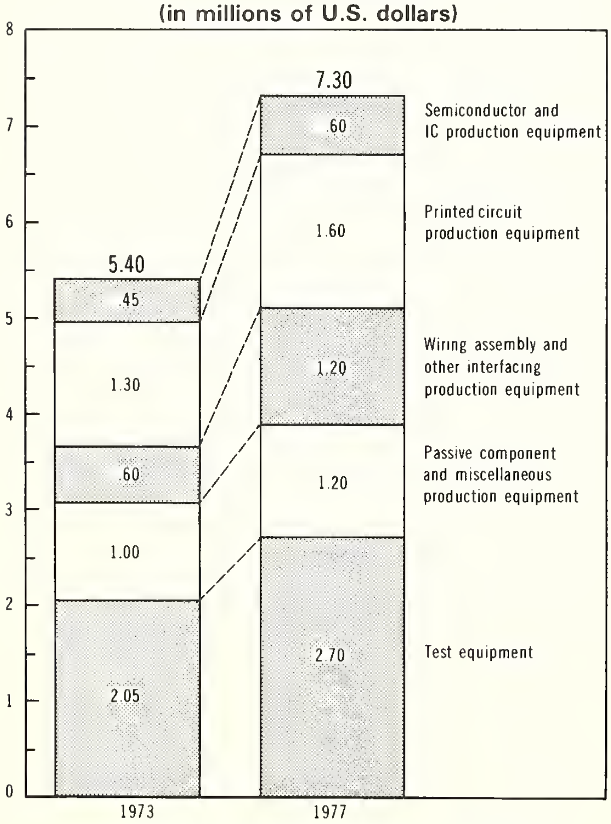
Electronics Industry Production Test Equipment
Belgium

Belgian manufacturers of electronics equipment are enlarging their production capacity to meet the growing demand for their products both at home and abroad. This expansion, and an accompanying trend toward modernization, should result in an average annual increase of nearly 8% in expenditures for electronics industry production and test (EIPT) equipment during the 1973-77 period.

The market for EIPT equipment, valued at $3.6 million in 1971 and $5.4 million in 1973 (see table 1), should climb to more than $7 million in 1977.

Belgium: Consumption of electronics industry production and test equipment, estimated 1973, and projected 1977

(in millions of U.S. dollars)



Source: Values based on U.S. Department of Commerce, Bureau of International Commerce, market research study.

Sales of all types of electronics industry production equipment in Belgium are expected to increase at an annual rate exceeding 8% between 1973 and 1977, rising from $3.4 million to $4.6 million. Forecasts show that the market for interfacing equipment will grow at the fastest rate during this period, increasing nearly 20% annually. The test equipment market is predicted to reach $2.7 million in 1977, a rise of nearly one-third over 1973 sales of $2.05 million.

Belgium's electronics industry is almost entirely dependent on imports for its production and test equipment. Domestic manufacture in 1972 amounted to only $480,000, or 10% of total consumption. The industry shows a clear preference for American products. Imports from the United States totaled $2.16 million in 1972, accounting for 45% of the total market, and are forecast to exceed $3.6 million in 1977, for a 50% share of the market.

Selected Sales Opportunities

Trade sources predict that the Belgian electronics industry will invest $26 million in production and test equipment during the 1974-77 period. Suppliers of interfacing equipment should find especially good sales opportunities as companies replace the manual wiring techniques currently in use. Belgian electronics manufacturers are also turning to advanced technology to solve their problem of quality control. Test equipment, particularly for the manufacture of semiconductors and printed circuits, has excellent sales potential.

Market research recently conducted in Belgium

Belgium—Selected Indicators (1972)

Gross national product:	**$35.6 billion**
Population:	**9.7 million**
Total country imports:	**$15.6 billion**
Total country exports:	**$16.1 billion**
Exchange rate (November 1973):	**36.6 Belgian francs = US$1**

for the Office of International Marketing of the U.S. Department of Commerce indicates that the products having the highest sales potential for American suppliers include:

- Semiconductor test equipment
- Wire test equipment
- Printed circuit board testers
- Chip evaluation equipment
- Cable harness equipment
- Crimping machines

The Electronics Industry

The Belgian electronics industry is rapidly increasing its production to meet accelerating demand in both the domestic and export markets. In an effort to improve production efficiency, manufacturers are turning to automation, more production processes, and advanced testing equipment.

Electronics industry primarily foreign-owned.—The Belgian electronics industry is dominated by large, multinational corporations, primarily of American, Dutch, or German origin. Although 70 firms now produce electronic equipment in Belgium, 70% of the total output comes from three companies—Ateliers de Constructions Electriques de Charleroi (ACEC), a Westinghouse subsidiary; Bell Telephone Manufacturing Company (BTM), a subsidiary of ITT; and Manufacture Belge de Lampes et de Materiel Electronique (MBLE), a subsidiary of Philips of the Netherlands. ACEC manufactures dielectric capacitors and electronic controls for transportation systems.

BTM, MBLE, and ATEA (an affiliate of GTE Sylvania, Inc.) are the largest producers of telecommunications equipment. These four firms also manufacture other professional electronic equipment, such as testing equipment for the process industries.

Major component manufacturers in Belgium are subsidiaries of American companies. RCA Solid State Europe, in Herstal, leads in the production of semiconductors, particularly power transistors. Ten firms manufacture printed circuits, and five companies produce passive components.

Other major end-product manufacturers include Siemens, a German subsidiary that produces teletype equipment, and Compagnie Belge de Radio et de Television (CBRT), a subsidiary of Philips that manufactures radio and television equipment. The small computer industry consists of subsidiaries of two U.S. corporations, Memorex and Burroughs.

Almost all Belgian manufacturers of electronic equipment subcontract part of their production to firms in other countries, and a large portion of the components and end-products made in Belgium are exported, mostly to other Common Market countries. Manufacturers have been exporting nearly 70% of their consumer goods and approximately 50% of their industrial products.

The Belgian Government supports innovation in domestic industry by financing up to 80% of the total cost of developing prototypes and new products. These loans are interest-free, with repayment delayed until the item can be profitably marketed. The government also encourages industries to move into economically depressed areas by offering special incentives, such as tax advantages.

Production increases forecast.—The Belgian electronics industry has been increasing production at an average annual rate of more than 20% since 1962, with output reaching $186.6 million in 1971. Production of electronic consumer goods is expected to grow about 15% annually through 1977, with the most dramatic rise occurring in the output of TV sets. Saba/Sylvania, a German-owned subsidiary of GTE, plans to double its production of color picture tubes to 540,000 per year, and several manufacturers are stepping up their production of black and white sets.

Domestic consumption of electronic components from all sources grew almost 19% annually between 1970 and 1973, while the market for assembled electronic equipment increased by over 13% per year. Purchases of color television sets have been increasing by almost 50% annually since 1970, reaching $24 million in 1972. The trend toward automation as a solution to Belgium's

Table 1.—Belgium: Consumption of electronics industry production and test equipment, estimated 1971-73

(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	0.40	0.40	0.45
Printed circuit production equipment	.70	1.10	1.30
Wiring assembly and other interfacing equipment	2.50	.70	.60
Passive component and miscellaneous production equipment		.80	1.00
Test equipment for production/inspection of electronic products		1.80	2.05
Total	3.60	4.80	5.40

Source: Values based on U.S. Department of Commerce, Bureau of International Commerce estimates.

rising labor costs resulted in computer sales of $112 million in 1973, a 15% increase over 1972.

The outlook for 1974-77 shows the greatest increases in the Belgian electronics equipment market occurring in the sales of computers, consumer goods, and telecommunications equipment. The market for computers is forecast to grow at an average annual rate of almost 25% through 1977, and sales of electronic consumer goods are expected to rise 15% per year during this period.

The ongoing modernization of the Belgian telephone system should contribute to projected annual increases in the telecommunications equipment market ranging from 15 to 18% through 1977. The first semielectronic public telephone exchange began operating at Berchem-Sainte-Agathe in June 1972; by the end of the year, 20,000 telephones were connected to the system. The government plans to build one centralized international exchange and 80 interurban exchanges, with nearly 1 million telephones operating through the system by 1980.

Manufacturers' Profiles

Compagnie Belge de Radio et de Television (CBRT), a subsidiary of Philips of the Netherlands, was established at Brugge in 1958 to assemble *radios* and *television receivers*. The company has become one of the major electronics firms in Belgium; it employed 11,000 people in 1972. CBRT has been steadily increasing its production capacity to supply both the domestic and export markets. Investment plans for 1973 included expenditures of $750,000 for test and control equipment and $250,000 for wiring equipment. The budget for 1974 through 1977 allocates $1.25 million for test and control equipment and $100,000 for wiring equipment. Smaller sums will be invested in other assembly and production equipment.

Siemens is a major producer of *teletype equipment* and represents its German parent company in sales of high-voltage products and electronic equipment for TV stations. The Belgian plant employs approximately 6,000 people and has annual sales of about $150 million. Current plans call for capital investments of about $55 million during the next 3 to 5 years.

Ateliers de Constructions Electriques de Charleroi S.A. (ACEC), which was acquired by Westinghouse in 1970, is one of the major Belgian manufacturers of *electronic meters and measuring equipment*. The company also produces power generators, motors, turbines, distribution transformers, and other industrial equipment. ACEC is actively modernizing its production facilities and recently redesigned its product line. ACEC opened a new factory in Jumet in September 1971 to produce a wide variety of *plastic dielectric capacitors;* this plant is reported to be one of the most modern of its type in Europe.

Bell Telephone Manufacturing Company (BTM), an Antwerp-based subsidiary of ITT, imports and assembles *telephone equipment* and manufactures *communications* and *test equipment*, including a wide variety of *electronic meters* and *measuring devices*. BTM has become the major supplier for the Belgian telephone modernization program and also has orders to furnish equipment and install similar exchanges in the Netherlands, Norway, Australia, and Hong Kong. To keep pace with the growing demand for its products, BTM is making large capital investments, including the purchase of sophisticated production equipment.

Competitive Environment

Domestic manufacture of EIPT equipment in Belgium is limited to in-house production by a few major electronics firms. The sole exception is a U.S. subsidiary, General Mechanics-Lecluyse P.V.B.A., which manufactures printed circuit production equipment in Antwerp. A full 90% of the EIPT equipment used in Belgium is imported, with the United States holding the largest share of the market (see table 2). Imports of EIPT equipment from the United States are expected to increase approximately 8% per year from 1973 to 1977 (see table 3).

Several U.S. firms have sales subsidiaries in Belgium. These include Hewlett-Packard and Tektronix, two of the most important suppliers of test equipment; Gerber Scientific, a producer of printed circuit production equipment; and Gardner-Denver International, which makes wiring assembly equipment. Two U.S. producers of test equipment, Teradyne, Inc., and Teledyne, Inc., are represented by agents.

U.S. companies and their European subsidiaries

Table 2.—Belgium: Consumption of electronics industry production and test equipment, by source and type of equipment, estimated 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	0.30	0.18	0.48
by other firms	*	*	*
Imported:			
from the U.S.	1.26	.90	2.16
from other countries	1.44	.72	2.16
Total	3.00	1.80	4.80

* Minimal.

Source: Values based on U.S. Department of Commerce, Bureau of International Commerce estimates.

supply 50 to 70% of the production equipment market and 60 to 70% of the test equipment market. Belgian electronics manufacturers prefer to buy American production and test equipment because they can choose from a wide range of high quality products, carefully designed for durability and performance.

Customer satisfaction could be further improved if U.S. equipment makers would adopt metric measurements, provide comprehensive warranties on expensive production equipment, and have sufficient spare parts locally available. American firms should also ensure that their Belgian distributors can provide an adequate number of technically qualified personnel to support equipment sales and service operations.

Belgian customs duties on EIPT equipment range from 5 to 13% and are based on c.i.f. value. A value-added tax is paid on the cost of the imported unit plus c.i.f. charges and customs duties.

Table 3.—Belgium: Consumption of electronics industry production and test equipment and U.S. market share (1971-77)

(in millions of U.S. dollars)

	1971	1972	1973	1974	1977
Total EIPT equipment market	3.60	4.80	5.40	6.20	7.30
Imports from the U.S. ______	1.62	2.16	2.70	3.10	3.65
U.S. market share (percent) __	45	45	50	50	50

Source: Values based on U.S. Department of Commerce, Bureau of International Commerce, estimates and projections.

Technical Requirements

Characteristics of electric current in Belgium are 220 volts, single-phase, 50 hertz, or 380 volts, 3-phase, 50 hertz. The metric system of weights and measures is used throughout the country.

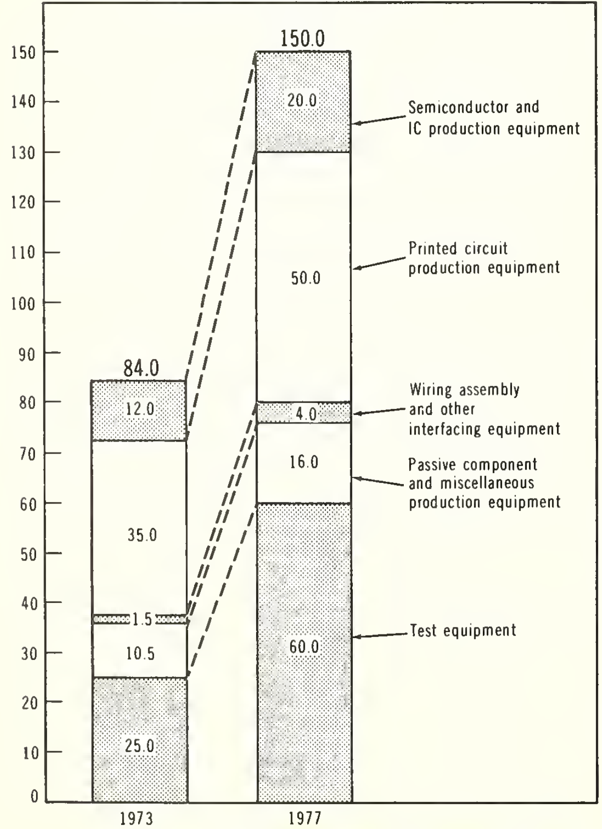
Further information on Belgian technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

France

The French Government's Sixth Plan for Economic and Social Development (1971-75) calls for annual production increases of 17% in the electronics industry. The Plan is intended to strengthen the position of French-owned firms in the world electronics market and expand the industry's output of consumer and professional electronic products to satisfy the growing domestic market.

To meet these production goals, French electronics firms will need to modernize their plants and adopt more automated procedures. The resulting increase in the demand for electronics industry production and test (EIPT) equipment will effect a 15.6% average annual increase of the French EIPT equipment market between 1973 and 1977. Sales, estimated at $59.5 million in 1971 and $84 million in 1973, should grow to $150 million in 1977 (see table 1).

France: Consumption of electronics industry production and test equipment, 1973, and projected 1977 (in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on French trade source estimates

American suppliers provide a large share of France's EIPT equipment. U.S. firms shipped over $25 million worth of equipment to France in 1972, realizing a 36% share of the market. Imports from all other foreign suppliers totaled $17.6 million and accounted for 25% of the market.

Domestic manufacturers produced $27 million of EIPT equipment in 1972, capturing a market share of approximately 38%. Of this total, $5.5 million represented equipment manufactured by electronics firms for their own use.

The growing French demand for U.S. automated test systems and high-capacity production equipment is expected to push the American share of the EIPT equipment market to 53% in 1977. Total sales of U.S. imports in 1977 should approach $80 million, more than triple the 1972 sales volume.

Selected Sales Opportunities

France's electronics industry is expected to invest at least $300 million for production equipment and about $180 million for test equipment during the next 4 years. A market research study recently conducted in France for the Office of International Marketing of the U.S. Department of Commerce indicates especially favorable sales opportunities for American manufacturers of EIPT equipment.

France—Selected Indicators
(1972)

Gross national product:	**$231 billion**
Population:	**50.3 million**
Total country imports:	**$26.6 billion**
Total country exports:	**$25.7 billion**
Exchange rate (November 1973):	**4.22 Francs=US$1**

Semiconductor and integrated circuit production equipment.—French purchases of semiconductor and integrated circuit production equipment, estimated at $12 million in 1973, are expected to climb to $20 million during the 1973-77 period, reflecting an average annual growth rate of 13.6%. This projected growth will result from the production increases planned by France's major semiconductor manufacturers and the efforts of many firms to compete successfully in the market for specialized types of integrated circuits. French imports of the following U.S. made equipment are expected to increase during the next 4 years:

- Substrate preparation equipment
- Artwork and pattern generation equipment
- Film deposition equipment
- Thick/thin film resistor trimmers

Printed circuit production equipment.—French expenditures for printed circuit production equipment are projected at $50 million in 1977. This market subcategory rose from $24 million to $35 million between 1971 and 1973, due in part to increasing demand for printed circuits in France's commercial, industrial, and military electronics sectors. U.S. manufacturers will find high sales potential in France for the following equipment:

- Cleaning and drying equipment
- Drilling machines
- Electroplating equipment
- Silk screen equipment

Wiring assembly and other interfacing equipment.—French consumption of wiring assembly and other interfacing equipment rose from $500,000 in 1971 to $1.5 million in 1973 and is expected to total $4 million in 1977. This would reflect an average annual growth of 28% during the 1973-77 period. Telecommunications equipment and consumer product manufacturers, who are increasing production in response to rising domestic demand, will be responsible for growing sales of interfacing equipment. U.S. suppliers should profit from the demand for equipment not locally produced, including:

- Color-coding machines
- Cutters
- Strippers
- Terminal-installing machines
- Connector assembly machines
- Card assembly machines

Passive component and miscellaneous production equipment.—Sales of passive component and miscellaneous production equipment in France are expected to reach $16 million in 1977. This represents an increase of more than 50% over the 1973 sales level of $10.5 million and almost 80% over 1971 sales of $9 million. Growing requirements for the following equipment, none of which is manufactured in France, should provide a viable market for American suppliers:

- Micromaterials handling and positioning equipment
- Coil winders

Test equipment for production/inspection of electronic products.—The growth in French demand for commercial electronic products, coupled with expansion in the telecommunications and computer manufacturing sectors of the industry, were contributing factors in the rise in the country's test equipment market from $14 million in 1971 to $25 million in 1973. Anticipated average annual increases of 24% in France's test equipment requirements should put the market at $60 million in 1977.

Approximately 70% of the electronics industry's current expenditures for test equipment is allocated for computer-controlled equipment, and French end-users should continue to purchase the most sophisticated test instruments and systems available. The advanced technology incorporated into American test equipment should enable U.S. manufacturers, who now satisfy more than 50% of France's test equipment requirements, to realize an even greater share of the market. French demand is expected to be strong for the following types of U.S.-made test equipment:

- Integrated circuit test equipment
- Transistor test equipment

Table 1.—France: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	12.0	10.0	12.0
Printed circuit production equipment	24.0	30.0	35.0
Wiring assembly and other interfacing equipment	.5	1.0	1.5
Passive component and miscellaneous production equipment	9.0	9.0	10.5
Test equipment for production/inspection of electronic products	14.0	20.0	25.0
Total	59.5	70.0	84.0

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study. Values based on French trade source estimates.

- Diode test and classification equipment
- Resistor test equipment
- Relay test equipment
- Wiring test equipment
- Printed circuit board testers
- Environmental test chambers
- Chip evaluation equipment
- Digital systems analyzers
- Wafer probing equipment
- Wire bond testers
- X-ray inspection equipment

The Electronics Industry

The production increases designated in the Sixth Plan and sharply rising wages in all sectors of the electronics industry have stimulated the interest of French electronics manufacturers in advanced EIPT equipment. The growing appreciation for the output capacities and laborsaving advantages of automated production and test systems should spur increasing expenditures for advanced EIPT equipment during the next few years.

Industry records steady growth.—France's electronics industry is the fifth largest in the world, ranking in sales behind the United States, Japan, Germany, and the United Kingdom. The industry includes some 570 firms with a total workforce of 171,000. Between 1970 and 1971, when the electronics industries of most other major countries recorded increases of less than 5% in sales, the French electronics industry recorded a rise of almost 20%; its volume went from $2 billion to $2.4 billion (see table 2).

Trade sources estimate the combined value of sales by the industry's three sectors—components; consumer electronics; and commercial, industrial, and military electronics—at $2.9 billion for 1972 and $3.2 billion for 1973.

The commercial, industrial, and military electronics sector leads the French electronics industry in both value of output and employment. Sales by this sector rose from $922 million to over $1.3 billion between 1969 and 1971, representing over 50% of total electronics industry sales in both years.

During the same period, employment in the sector increased from 74,000 to over 83,300 persons (see table 3). The steady growth of this sector can be credited in part to a high level of Government spending, particularly by the Ministry of Defense, for telecommunications, radar, navigational, and professional radio and television equipment. Government purchases have accounted for over 60% of all sales of this equipment in recent years.

Electronic products, EDP equipment, and measurement and control instruments manufactured in France have also gained a strong position in the European market. Export sales by the commercial, industrial, and military electronics sector totaled $387 million in 1970 and $507 million in 1971.

French Electronics Industry—Basic Data
(1972)

Total value of production:	**$2.9 billion**
Number of manufacturers:	**570**
Industry labor force:	**171,000**
Total value of components:	**$704 million (1971)**
Total value of end products:	**$1.7 billion (1971)**
Output of selected products:	
Semiconductors	**$140 million**
Radio receivers	**$58.8 million**
Television receivers	**$335 million**
Recording equipment	**$116.4 million**

Component manufacturers claimed about 38% of the industry's total employment in 1971 and accounted for 29% of sales. The production value of components rose from $589.3 million in 1969 to $704.4 million in 1971, while the sector's workforce increased from about 60,000 to more than 64,000 persons. Sector gains in recent years have resulted primarily from sales of industrial electronic tubes, circuit breakers, transformers, and printed circuits.

Table 2.—France: Electronics industry sales, 1969-1971 and projected 1975

(in millions of U.S. dollars)

	1969	1970	1971	1975[1]
Components	589.3	667.2	704.4	1,016.0
Commercial, industrial, and military products	921.6	1,037.8	1,356.9	2,716.0
Telecommunications and other professional electronic products	448.9	472.6	657.5	—
EDP equipment; measurement and control instruments	472.7	565.2	699.4	—
Consumer products:	301.0	338.7	388.1	850.0
Radio receivers	43.9	47.3	50.3	94.2
Television receivers	187.0	217.5	249.0	530.0
Electroacoustic equipment	70.1	73.9	88.8	225.8
Total electronics industry sales	1,811.9	2,043.7	2,449.4	4,582.0

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[1] Breakdown of projected commercial, industrial, and military electronic product sales not available for 1975.

Sources: Sales figures for 1969-71 based on data provided by the French Federation of Electronic Industries. Projections for 1975 from French Government publication, "Rapports des Comites du VIe Plan 1971-1975, Electronique — Informatique — Telecommunications," 1971.

Semiconductor sales rose from $104 million in 1969 to $121 million in 1970, but dropped to $107 million in 1971. Industry sources indicate that semiconductor sales are again on the rise, with sales by French manufacturers estimated at $140 million in 1972 and expected to reach $177 million by the end of 1973.

France's consumer electronics sector recorded a 29% increase in sales during the 1969-1971 period; sales increased from $301 million to $388 million. The improvement resulted primarily from strong domestic demand for such products as color television sets, auto radios, and electroacoustic equipment.

Domestic manufacture of car radios totaled 778,400 units in 1971 and accounted for 80% of all those sold in France; in 1970, the French produced 76% of all auto radios sold locally, or 632,320 units. French production of television receivers in 1971, estimated at almost 1.6 million sets, was valued at $249 million and accounted for almost 65% of the consumer electronics sector's total turnover in that year. Estimates put the total unit production of TV receivers at $335 million (1.62 million units) in 1972 and over $420 million (1.7 million units) in 1973.

Thomson-Brandt Group leads industry.—The Thomson-Brandt Group, a domestically owned enterprise, is the giant of the French electronics industry; its 1971 sales of diversified electronic products aggregated over $1 billion. Thomson's workforce in 1971 topped 80,000, and its manufacturing and research facilities numbered about 75. Companies within the Thomson-Brandt Group, particularly Thomson CSF, are leaders in all sectors of the French electronics industry.

Thomson's affiliated component manufacturers include Societe Sescosem, LCC-CICE, Orega CC, Socapex, Cofelec, and Cintres Polyvalents de Production Electronique de Thomson CSF. Two of France's leading computer manufacturers, Compagnie Internationale pour l'Informatique (CII) and Compagnie des Compteurs, are also part of the Thomson Group.

Other Thomson affiliates include Continental Edison, which manufactures radio and television receivers and audiovisual equipment, and Groupement des Applications Nucleaires et de l'Instrumentation Scientifique (GANIS), France's leading manufacturer of engineering and scientific instruments.

Table 3.—France: Electronics industry employment, 1969-71

Industry sector	1969	1970	1971
Commercial, industrial, and military electronic products	74,027	76,558	83,322
Components	60,051	64,666	64,047
Consumer electronic products	22,680	21,103	19,637
Total employment	156,758	162,327	167,006

Source: Employment figures based on data supplied by the French Federation of Electronic Industries.

Compagnie Generale d'Electricite (CGE), another leading French electronics firms, had total sales of almost $1.9 billion in 1971, of which $326 million came from sales of telecommunications equipment. Its affiliate, CIT Alcatel, a leading microelectronics producer, had sales of $214 million in 1971.

Other French-owned domestic component manufacturers include Silec Semiconducteurs, Souriau et Cie, and La Telemecanique Electrique (LTE). LTE is also a major manufacturer of professional electronic products. Le Materiel Telephonique (LMT), Societe Anonyme des Telecommunications (SAT), and Telecommunications Radioelectriques et Telephoniques are three top French manufacturers of telecommunications equipment; Schneider Radio TV is a leader in consumer electronics production.

Some 245 firms in the French electronics industry are subsidiaries of overseas companies; most of these are controlled by U.S. firms. American investments in the French electronics industry totaled $80.4 million for the 1965-1968 period and were primarily focused in computer electronics. These investments accounted for 82% of all foreign investment in France during that period.

Compagnie IBM France, France's leading manufacturer of data processing equipment, is also the country's leading exporter of electronic equipment. Its 1971 exports represented more than 40% of IBM France's total sales. Subsidiaries of Honeywell, Inc., Control Data Corp., Burroughs Corp., and NCR are also among France's top manufacturers of EDP equipment.

Manufacturers of measurement, test, and control instruments in France include subsidiaries of Hewlett-Packard, Teradyne, General Instruments Corp., Tektronix, Inc., and Schlumberger.

Subsidiaries of ITT in France include Compagnie Generale Construction Telephonique, a major manufacturer of telecommunications equipment, and two firms in the consumer electronics sector, Sonolor and Oceanic. ITT subsidiaries manufacturing basic electronic equipment and components include ITT Division MTI and ITT Division Intermetall. Subsidiaries of RCA, Westinghouse Electric Corp., Motorola, Inc., Texas Instruments, Inc., Ampex Corp., and Fairchild likewise hold strong positions in the French market for components.

La Radio Technique Compelec, a French subsidiary of the Philips Group of the Netherlands, designs and develops all types of components and produces subassemblies, including computer storage units and modular input devices. La Radiotechnique, another member of the group, manufactures consumer electronics products including radios, televisions, and sound recording equipment. Philips Data Systems is a leading manufacturer of small and medium-size office computers.

Increases expected in production, exports.—France's Sixth Plan for Economic and Social Development aims to strengthen the position of French electronics manufacturers in the domestic and world markets by promoting expansion in all branches of the industry and encouraging the formation in each sector of a single group that can compete in the international market.

The Plan, which covers the period 1971-1975, calls for production increases averaging 17% annually in the electronics industry. Total sales are expected to top $4.5 billion in 1975; in 1970 industry sales totaled $2 billion. Export sales, which totaled $693 million in 1970 and $865.6 million in 1971, are expected to approach $1.2 billion in 1975.

Total expenditures for research and development (R&D) in the electronics industry during the period of the Sixth Plan should exceed $1.8 billion. An estimated $419 million is intended for component research and development, with emphasis on semiconductor, memory grid, and laser applications. R&D expenditures of $466 million will be used to build up France's manufacture of measuring instruments, aircraft and ground navigation systems, and space electronic products.

Expenditures for telecommunications equipment and EDP research are estimated at $516 million and $433 million, respectively. The French Government in recent years has subsidized about 60% of the electronics industry's R&D costs and should continue to provide strong financial backing, particularly for research in telecommunications, data processing, and measurement and control equipment manufacturing.

Sales by France's fast-growing commercial, industrial, and military electronics sector are expected to reach $2.7 billion in 1975, representing a 21% average annual rate of increase from the 1970 level of $1.03 billion. Exports should approach $650 million in 1975, an almost 70% increase over the 1970 level of $387.3 billion. Sales of telecommunications equipment, scientific and measuring instrumentation, and EDP equipment are expected to show the greatest growth during the next few years.

Virtually all telecommunications equipment manufacturers in France have undertaken or are planning large-scale programs to upgrade and modernize their production facilities. Improving telecommunications facilities, including the development of an electronic switching system, is one of the Plan's priority considerations, and local industry sources can expect a high level of Government spending within the sector. Domestic sales of telecommunications equipment by French firms, estimated at $500 million in 1970, are projected to approach $1.3 billion in 1975.

Domestic manufacturers of scientific measurement and control instrumentation are expected to increase their share of the domestic market from 65% in 1973 to 85% in 1975. An intensified program developed by France's Ministry of Industrial and Scientific Development will contribute to the expansion of this segment of the electronics industry.

The program provides incentives to manufacturers of scientific and nuclear measuring instruments who increase automation in their production processes. In addition, firms manufacturing test instruments are being encouraged to expand their representation in foreign countries, with the objective of increasing the proportion of exports to one-fourth of total sales by 1975. Some reorganization, primarily through mergers, can also be expected to assist firms manufacturing military avionics equipment to adapt their products for the civilian aircraft market.

Many of France's computer manufacturers are already investing heavily in new model development and have expanded production in compliance with the Government's Plan Calcul, which is intended to strengthen the French computer industry. Joint research and manufacturing ventures with major foreign computer manufacturers, such as the one being considered by Thomson's CII, Philips of the Netherlands, and Siemens of Germany, are also being implemented to strengthen France's position in the world market.

The increase in French demand for consumer electronic products is the underlying cause of recent expansion efforts in the domestic consumer products industry. Sales of these products totaled an estimated $635 million in 1973 and are expected to climb to $850 million in 1975.

Television sales should represent over 60% ($530 million) of the sector's total sales in 1975. French production of television receivers in 1973 was estimated at over 1 million black and white sets and 560,000 color sets. The number of color television receivers required to meet domestic demand in 1975 should reach 790,000, and the number of black and white sets is estimated at 980,000.

Despite a recent rise in French imports of radios from Southeast Asia, French radio manufacturers expect their sales to reach $94.2 million in 1975. This would represent an increase of about 30% over estimated 1973 sales of $73 million. Electroacoustic equipment represents one of France's fastest growing markets and in 1975 it should total $225.8 million, up more than 50% from 1973 estimated sales of $142 million and more than 80% over 1972 sales of $116.4 million.

Component manufacturers in France anticipate increased sales, averaging 8.8% a year during the 1970-1975 period, with total sales expected to exceed $1 billion in 1975. Many manufacturers have already begun large-scale modernization programs aimed at expanding their total output and augmenting their microelectronics capabilities.

Specific production goals include mass production of components used by domestic EDP equipment and consumer electronics products manufacturers and expanded output of MOS and ECL high-speed integrated circuits required by domestic telecommunications equipment producers.

Passive component manufacturers, encouraged by Government grants, are expected to concentrate their R&D efforts on capacitors, potentiometers, connectors, and printed circuits.

The French Government hopes to establish an international semiconductor manufacturing group based on Thomson's Sescosem. Thomson has already taken steps to improve its international position through the formation, with RCA, of the Videocolor Company, which will mass-produce color television CRT's for the European market.

Component Manufacturers' Profiles

France's three top component manufacturers produce a wide range of components using semi-automated and automated production lines. These firms also have some of the most advanced testing equipment in use in France's electronics industry.

Thomson CSF is the component and industrial electronics division of France's Thomson-Brandt Group. The electronic components branch of Thomson CSF employs 12,000 persons and is made up of the Active, Passive, and Electromechanical Components Divisions.

The combined turnover of the components divisions in 1972 was $169 million. Sales of *capaciters* and *resistors* by the Passive Components Division, which includes LCC-CICE and Precitechnique of France and Ducati of Italy, totaled $72 million. The four firms in the Electromechanical Components Division—Socapex, Cepe, Cofelec, and Orega CC—sold *connectors, quartz components, memories, printed circuits, relays,* and *subassemblies* valued at $50 million in 1972. Sales of *silicon and germanium diodes and transistors, FET and MOS transistors, silicon power transistors, Zener diodes, rectifiers and subassemblies, high frequency elements,* and *logic and linear integrated circuits* by the Active Components Division totaled $47 million in 1972.

The Active Components Division employs a total of 3,600 persons at its Sescosem plant in Aix en Provence and at its Mistral plant in Italy. The Division's output is about 300 million components per year. Total capital investment by the Division is estimated at $400 million.

The Sescosem manufacturing plant is one of the most advanced in France's electronics industry. Sescosem has semiautomatic production lines for the manufacture of power transistors, Zener diodes, and industrial linear circuits; its fully automated production line for the manufacture of switching diodes has a capacity of 1 million units per day. Sescosem also has over 25 automatic semiconductor test systems, including one of the few dynamic integrated circuit testers in France.

Sescosem has doubled its production each year since 1969; this trend is expected to continue, at least through 1974. The firm will concentrate its machinery investments on equipment needed for the manufacture of MSI circuits, memories, and industrial linear circuits.

La Radio Technique Compelec (RTC), a French component manufacturing subsidiary of Philips, employs over 10,000 persons at its factories in Caen, Evreux, Suresnes, and Dreux. Its production staff numbers about 6,000. During the past few years, RTC has maintained an annual sales volume of over $140 million, more than 35% of which was realized from export sales.

RTC's semiconductor and microelectronics sector, which accounts for about 25% of the company's sales, manufactures *signal diodes and transistors, power transistors, Zener diodes, high frequency elements* such as *solid klystrons* and *Gunn oscillators,* and *logic, linear, MOS, ECL, and MSI circuits.* About 30% of RTC's annual turnover is from sales of passive components including *capacitors* and *resistors;* 20% is from sales of subassemblies including *computer memory grids, solar generators,* and *altitude measuring devices;* and 25% is from sales of *electron tubes.*

RTC recently has had large capital equipment expenditures for its development work in ECL high-speed integrated circuits, color television circuits, optoelectronic elements, and energy storage capacitors. RTC spent $4 million for EIPT equipment in 1972. RTC has both automated and semi-automated production lines, and, like Thomson CSF, has one of the few computer-controlled integrated circuit testers with dynamic memory capability.

France's third largest component manufacturer is *Silec Semiconducteurs (SSC)*. The company, which was established in the late 1950's, has plants in Villejuif, Alencon, and Tours. Its staff of 1,100 includes 30 development engineers and 700 production workers. SSC's sales in 1972 totaled $14 million, about $2.8 million of which was derived from exports.

SSC produces more than 50 different types of components. Its major products are *single and three-phase rectifiers, high-speed power thyristors, triacs, Zener and Schottky diodes, alternating power vari-*

ators, and *single-junction transistors.* Total annual production is estimated at 100 million units, including 1.5 million triacs and thyristors.

SSC allocates about 15% of its annual sales turnover for research and development and about 3% for EIPT equipment purchases. In 1971, the firm spent $300,000 for production equipment and $100,000 for test equipment. SSC has semiautomatic production lines and computer-controlled component sorting equipment, including a triac sorting system and a diode tester. The process allows for the simultaneous sorting of rectifier and Zener diodes at the rate of 15,000 units per hour.

End-Product Manufacturers' Profiles

Increasing sales of televisions, radios, and phonographs in France have resulted in substantial production increases by most of France's manufacturers of consumer electronic products.

A Philips subsidiary, *La Radiotechnique,* manufactures and assembles *radio and television receivers* at its plants in Nogent-le-Rotrou, Lille, and Dreux. *Sound recording equipment* is produced at its plant in Rambouillet. The company's 1971 sales turnover was $128 million, and capital investment in 1971 was estimated at $1.3 million.

La Radiotechnique's sales of TV sets increased from $64 million in 1970 to $78.8 million in 1971, when 220,000 black and white sets and 134,000 color sets were produced by the firm. Between 1970 and 1971, its unit production of car radios increased by 50% and sales by 100%. French demand for cassette recorders and high-fidelity equipment enabled La Radiotechnique to increase its 1971 sales of sound recording equipment by 17% over 1970.

The consumer goods sector of the *Thomson-Brandt Group* is one of France's major manufacturers of *television receivers, radios,* and *electroacoustic equipment.* The sector's total turnover was about $470 million in 1972 and included sales of both electrical and electronic equipment.

Over one-third of the television sets manufactured in France are Thomson products. The company increased its production of television sets from 405,000 in 1970 to 600,000 in 1972. Color television production rose from 40,000 units in 1970 to 137,000 units in 1972, and the firm expected to sell over 500,000 color sets in 1973. Thomson's production of radios and auto radios rose from about 410,000 to 490,000 units between 1970 and 1971. A 16% increase in the firm's production of phonographs was recorded during the same period, with production expanding from 150,000 units in 1970 to 175,000 units in 1971.

The Competitive Environment

Approximately 80 manufacturers and distributors of production equipment and 70 manufacturers and distributors of test equipment supply the EIPT equipment market in France. Imports represent a significant share of both market segments; in 1972, imports accounted for 60% of the production equipment and 65% of the test equipment purchased by France's electronics industry (see table 4).

Local production limited.—French electronics manufacturers produce a relatively small amount of EIPT equipment for their own consumption, and most of the equipment produced is for limited and highly specialized applications. This equipment manufacture often consists of the assembly of purchased system parts, as in the case of Thomson CSF, which produces some of its own equipment using U.S.-made subassemblies and components.

Production equipment manufactured for in-house use in 1972 was valued at $2.5 million and represented 5% of the French production equipment market. Test equipment produced in-house was valued at $3 million and represented 15% of the French test equipment market.

Domestic manufacturers of EIPT equipment, including subsidiaries of U.S. and other foreign firms, satisfied 35% ($17.5 million) of the electronics industry's production equipment requirements and 20% ($4 million) of its test equipment requirements in 1972.

Included among the major French manufacturers of production equipment are Anglade et Cie, which produces electroplating machines for printed circuits; V. Bouzard et Ses Fils, photoprinters, etching machines, and other printed circuit production equipment; Benson, automatic tracing machines for integrated and printed circuits; and Millipore, which manufactures some of its printed and integrated circuit production equipment under U.S. license.

Synelec is France's major supplier of wiring machines and one of the country's leading manufacturers of test equipment, including integrated circuit testers. Other major French manufacturers of test

Table 4.—France: Consumption of electronic industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	2.5	3.0	5.5
by other firms	17.5	4.0	21.5
Imported:			
from the U.S.	15.0	10.4	25.4
from other countries	15.0	2.6	17.6
Total	50.0	20.0	70.0

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study. Values based on French trade source estimates.

and measuring equipment include Agelec, AOIP Measurements Division, CIT Alcatel, Laboratoire Electroacoustique, and Thomson's GANIS division. Also supplying the French test equipment market are French manufacturing subsidiaries of the U.S. firms ITT and Schlumberger, Netherlands' Philips, and Germany's Heraeus.

Societe Metrix, part of the ITT France Group, manufactures test equipment, including vacuum tube testers, transistormeters, impedance bridges, integrated circuit analyzers, and card testers. About 70% of Metrix's output is sold in France, 25% is sold to other European countries, and 5% is exported to the United States.

The Schlumberger subsidiary Societe Schlumberger-Instrumentation et Systemes, which produces transistor, diode, and integrated circuit testers, sells about 50% of its diode and transistor test equipment to Eastern European countries. Schlumberger sells its integrated circuit test equipment only in France.

Heraeus of Germany, which maintains a manufacturing plant in Orly, sells climatic testing equipment in France. Philips of the Netherlands also has an EIPT equipment manufacturing facility in France and produces transistor and integrated circuit testers and measurement, test, recording, and regulating equipment.

U.S. leads foreign suppliers.—The United States claims a substantial portion of the French EIPT equipment market and led all other foreign suppliers in both market segments in 1972. In that year, U.S. firms sold $15 million worth of production equipment in France, or 30% of the market, while French imports of American-made test equipment totaled $10.4 million and represented 52% of the French test equipment market.

The United States is expected to hold an even stronger position in France's EIPT equipment market in upcoming years despite decreased import duties on such equipment imports from fellow members of the European Economic Community (EEC) and a Sixth Plan policy encouraging French trade with other EEC members.

U.S. suppliers should increase their share of the French production equipment market to 40% in 1974 and 45% in 1977, with sales expected to total $28 million and $40.5 million, respectively (see table 5). Imports of American test equipment should climb to $21 million in 1974, representing 60% of the test equipment market, and to $39 million in 1977, a 65% market share.

French imports of production equipment from countries other than the United States totaled $15 million in 1972 and accounted for 30% of total domestic production equipment sales. Imports of test equipment in the same year totaled $2.6 million and represented 13% of the test equipment market.

Table 5.—France: Imports from the U.S. of electronics industry production and test equipment, 1972, and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	15.0	28.0	40.5
Test equipment	10.4	21.0	39.0
Total	25.4	49.0	79.5

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study. Values based on French trade source estimates.

Major suppliers of production equipment from the United Kingdom include Fry's Metal, Ltd.; ICI; and Ferranti, Ltd. Germany is represented by Ernst Lenz, Merz, and Ersa Ernst Sachs, among others. Contraves of Switzerland and Pluda Fratelli of Italy also sell production equipment in France. Major British suppliers of test equipment include Ferranti, Cambridge, Plessey, and Scientific Instruments, Ltd. Major German test equipment suppliers include Carl Zeiss and Rhode and Schwartz.

Trade barriers minor.—Imports of EIPT equipment from the original members of the EEC are not subject to custom duties, and duties on imports from the United Kingdom and Denmark are being eliminated gradually by reductions of 20% per year. Duties on EIPT equipment of American origin range from 6.5 to 13%. France also has a value-added tax of 20% that is applied to both imported and domestically produced equipment. Additional information concerning import duties may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Washington, D.C. 20230.

Technical Requirements

The characteristics of electric power supply in France are 220 or 380 volts, 50 hertz. The metric system of weights and measures is used.

Additional information on technical standards in France can be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

The following market research study is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M, Main Commerce Building, Washington, D.C. 20230:

"The Market for Electronics Industry Production and Test (EIPT) Equipment in France," DIB 74-01-509, April 1973.

Germany

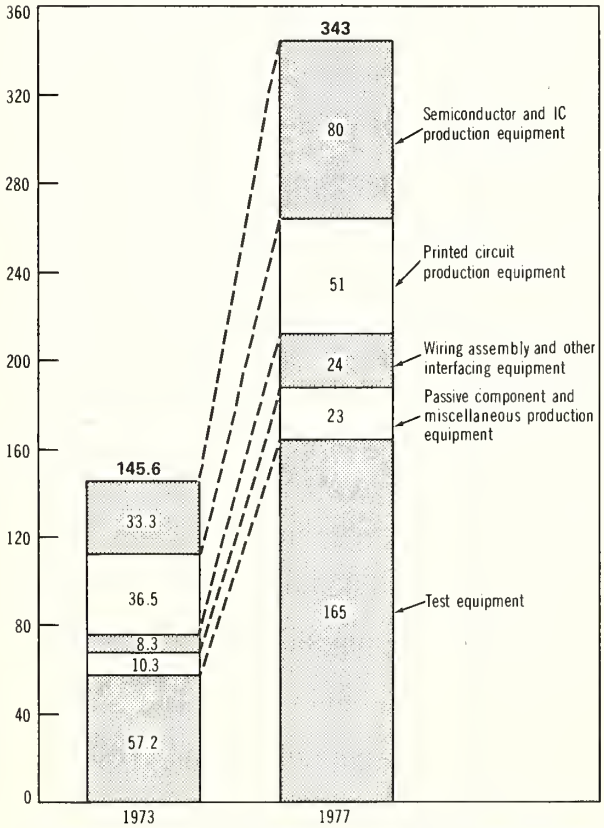
Germany's electronics industry anticipates a rise in output from $6.3 billion in 1972 to more than $10 billion in 1975, a rise of some 60%.

Encouraged by booming sales of electronic communications equipment, components, and entertainment products, as well as sustained growth in the computer market, German firms are stepping up their investments in the latest automated production and test machinery.

The country's market for electronics industry production and test (EIPT) equipment is projected to reach $343 million in 1977, reflecting an average growth of 24% a year from the estimated $146 million in sales in 1973 (see table 1). The 1973 value represents a 36% increase over 1972, when the market amounted to $107.1 million.

Germany: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on German trade source estimates.

Germany's imports of U.S. EIPT equipment, valued at $42.2 million in 1972, or almost 40% of the market, are projected to exceed $187 million in 1977. This anticipated 35% average annual increase surpasses the growth rate predicted for the market as a whole and is due in large part to the advanced equipment offered by U.S. firms.

Imports of EIPT equipment into Germany from countries other than the United States totaled $8.2 million in 1972. Domestic sources provided $56.7 million in EIPT equipment, including $32.4 million worth of equipment produced by electronics firms for in-house use. Commercial firms supplied the remaining $24.3 million worth of locally fabricated equipment.

Selected Sales Opportunities

A market research survey recently conducted in Germany for the Office of International Marketing of the U.S. Department of Commerce reveals highly favorable sales opportunities for American manufacturers of the following types of EIPT equipment.

Semiconductor and integrated circuit production equipment.—The German market for semiconductor and integrated circuit (IC) production equipment is expected to top $80 million in 1977, reflecting an average annual increase of 25% over the 1973

Germany—Selected Indicators (1972)

Gross national product:	**$258.9 billion**
Population:	**61 million**
Total country imports:	**$40.2 billion**
Total country exports:	**$46.6 billion**
Exchange rate (January 1974):	**2.73DM = US$1**

estimated level of $33.3 million (see table 2). The market stood at $20.3 million in 1971. The anticipated rapid growth corresponds to the trend toward a highly specialized and diverse use of semiconductors by German electronics firms. Items that offer excellent sales opportunities to American manufacturers include:

- Step-and-repeat cameras
- Epitaxial growth equipment
- Chemical milling etchers
- Conveyor, diffusion, and firing furnaces
- Ion implantation equipment
- Laser scribing machines
- Thermocompression and ultrasonic bonders
- Diode sputtering equipment
- Wafer dicing equipment
- Wafering machines
- Wafer process lines, automated
- Computer-controlled mask alignment systems
- Leak detectors
- Thick/thin film resistor trimmers
  - air abrasive
  - laser
- Film thickness measuring equipment
- Dice mounters

American manufacturers fill virtually all the German demand for epitaxial growth equipment and film thickness measuring equipment. Both of these items now are more than $1-million markets. Sales of ion implantation equipment, recently introduced in Germany, also are estimated at $1 million; U.S. industry supplied 60% of this market during 1973.

About 65% of the estimated $1.25-million German market for wet process chemical etchers was accounted for by U.S. firms in 1973. Combined sales of other types of etchers and scribers, including plasma etching equipment and laser scribers, were about $500,000 in 1973; 80% of the equipment was U.S.-supplied.

Approximately 50% of the country's need for leak detectors and furnaces is met by imports of U.S. equipment. Purchases of leak detectors/testers were valued at roughly $1 million in 1973. A breakdown of the $1.8-million German market (1973) for furnaces reveals that two-thirds of the sales were of firing-conveyor types and the remainder, diffusion furnaces. A projected average annual growth rate of 15% for furnace sales to the electronics industry is expected over the next few years.

American producers fill about 50% of the demand for traditional wafer-processing equipment and virtually all the automated machinery requirements. Estimates placed the total market for both types of wafer-processing equipment at just under $1 million in 1973. The U.S. share of the market for wafer and die sorters, estimated at $1 million, was 60%.

Sales of U.S. computer-controlled mask alignment systems, recently introduced on the German market, are expected to amount to $500,000 in the 1973-74 period and should increase by 20% annually through 1977. The current market for bonders is about $1 million a year. The anticipated introduction of third-generation bonders in 1975 should boost sales appreciably.

Printed circuit production equipment.—Germany's printed circuit (PC) production equipment market is expected to increase by almost 40% by 1977, rising to nearly $51 million from an estimated $36.5 million in 1973. Sales amounted to $22.2 million in 1971. Good export opportunities exist for U.S. suppliers of the following items:

- Ultrasonic and plasma cleaning equipment
- Photoprinters
- Etching machines
- Drilling machines
- Computer-controlled axial-lead component inserters
- Computer-controlled component-sequencing systems
- Component handling systems
- Thin film coating machines

Drilling machines represent one of the fastest growing segments of the PC production equipment market. From a 1973 base estimated at approximately $2.5 million, sales should increase by 15 to 20% annually through 1977; American industry should retain its current 40% share. Growth expectations also are high for sales of automatic component sorters. U.S. firms supplied 80% of German requirements for computer-controlled component sequencing systems and component handling sys-

Table 1.—Germany: Consumption of electronics industry production and test equipment, 1971-73

(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	20.3	25.4	33.3
Printed circuit production equipment	22.2	27.9	36.5
Wiring assembly and other interfacing equipment	4.8	6.0	8.3
Passive component and miscellaneous production equipment	6.0	7.5	10.3
Test equipment for production/inspection of electronic products	32.0	40.3	57.2
Total	85.3	107.1	145.6

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on German trade source estimates.

Table 2.—Germany: Estimated market for selected EIPT equipment and U.S. market share, 1973
(in millions of U.S. dollars)

Product	Market size	U.S. share (percent)
Semiconductor and IC production equipment		
Epitaxial growth equipment	1.1	100
Film thickness measuring equipment	1.1	99
Chemical milling etchers	1.2	65
Conveyor, diffusion, and firing furnaces	1.8	50
Ion implantation equipment	1.0	60
Printed circuit production equipment		
Etching machines	5.3	65
Drilling machines	2.5	40
Automatic component sorters	1.1	80
Wiring assembly and other interfacing equipment		
Wire-wrap systems	.7	80
Terminal-installing machines	1.0	50
Wire measuring, cutting, and stripping machines	1.4	70
Passive component and miscellaneous production equipment		
Micropositioners	1.6	80
Flow boxes	3.5	50
Test equipment		
Component life testers	12.4	80
Automatic test systems	2.5	80
Signal sources	5.3	50
Spectrum analyzers	2.3	90
Network analyzers	1.6	80

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

tems, which together recorded sales in excess of $1 million in 1973.

U.S. industry supplied 65% of the market for etching machines, which was valued at over $5 million in 1973. The German market for cleaning equipment, estimated at almost $2.2 million in 1973, was divided as follows: about $1.4 million in ultrasonic equipment; $700,000 in brush types; and about $75,000 in plasma cleaning equipment. American industry supplied about 25% of the market for ultrasonic apparatus and nearly all of Germany's requirements of the increasingly popular plasma type machinery.

Wiring assembly and other interfacing equipment.—From a modest base of $4.8 million in 1971, the market for interfacing equipment rose to an estimated $8 million in 1973 and is projected to reach $24 million in 1977, representing an average annual growth rate of 30%. Accelerated production of communications equipment, process control instruments, and electronic parts for automobiles, as well as sustained growth in computer output, are the primary factors spurring demand. Highly salable items for U.S. producers include the following:

Germany's Electronics Industry—Basic Data (1972)

Total value of production:	**$6.3 billion**
Number of manufacturers:	**220**
Industry labor force:	**343,560**
Total value of components:	**$1.1 billion**
Total value of end products:	**$5.2 billion**
Output of selected products:	
Communications equipment	**$740 million**
EDP equipment	**$1.3 billion**
Consumer electronic equipment	**$1.9 billion**

- Wire-wrap systems
- Automatic-reflow soldering systems
- Automatic welding systems
- Color-coding machines
- Crimping machines
- Terminal-installing machines
- Wire measuring, cutting, and stripping systems

Demand for wire-wrap systems is expected to rise by 30% a year as German manufacturers replace their current systems with the newer automated, numerically controlled models now available. U.S. exporters supplied about 80% of this $700,000-market in 1973.

American producers and their European subsidiaries accounted for 70% of the estimated 1973 market of $1.4 million for wire measuring, cutting, and stripping machines. U.S. industry filled one-half of Germany's needs for semiautomatic terminal-installing machines and all of the country's requirements for fully automated systems. Together, sales of semi- and fully automated systems were valued at about $1 million in 1973.

Automatic welding systems should offer a continuing lucrative market for U.S. exporters who are, to date, the only suppliers. Sales potential for this equipment is estimated to be several hundred units a year, and a $1.8-million market is forecast for 1977. Color-coding, marking, and numbering machines also are new to Germany and should offer good sales opportunities to U.S. industry, which now fills more than 50% of the demand for such machinery.

Passive component and miscellaneous production equipment.—This segment of the EIPT equipment market should more than double between 1973 and 1977, going from an estimated $10.3 million to $23 million. The level projected for 1977 is almost four times the 1971 market of $6 million. The continuing shortage of labor, particularly of skilled workers, is an important reason for German manufacturers to step up their purchases of passive component and other production equipment.

The German market for micropositioners, estimated at $1.6 million in 1973, is expected to increase by 15 to 20% a year through 1977, and U.S. industry should retain its current 80% share. The estimated $2.8- to $3.5-million market for clean boxes offers good sales opportunities to U.S. companies, which filled about one-half the demand for these products in 1973.

Test equipment.—The growing demand for fully guaranteed components should yield an average annual increase of 30% in sales of test equipment, projected to rise from an estimated level of $57.2 million in 1973 to almost $165 million in 1977. Investments in test equipment were valued at $32 million in 1971. Among the items with the greatest sales potential for U.S. manufacturers are the following:

- Integrated circuit test equipment
- Transistor test equipment
- Diode test equipment
- Printed circuit board testers
- Printed circuit repair boards
- Wafer-probing equipment
- Semiconductor probing equipment
- Signal generators
- Sweepers
- Spectrum and network analyzers
- Temperature test chambers

The growing specialization of components is expected to result in increased sales for test equipment suppliers. Component manufacturers and users, who are not even attempting to design their own test equipment for MOS and LSI, are expected to replace test equipment fabricated in-house with the latest state-of-the-art machinery. Such purchasers are turning more and more to computerized systems capable of checking all parameters.

U.S. industry has a pronounced technological lead in the manufacture of test equipment and could benefit from the German trend toward using the most advanced machinery available.

The German market for all types of component life testers in 1973 totaled an estimated $12.4 million; the U.S. share of this market was 80%. Of this amount, computer-controlled equipment represented sales of $8.9 million, and purchases of manually operated and semiautomatic machinery were valued at $3.5 million. Sales of IC and PC board testers, included in the market for component life testers, were each estimated at $3.5 million in 1973.

U.S. suppliers furnished 80% of the estimated $2.5-million German market for automatic test systems in 1973. A 15 to 20% annual growth rate is forecast through 1977.

The 1973 market for spectrum analyzers was estimated at $2.3 million and for network analyzers at $1.6 million. The U.S. share was 90% and 80%, respectively. American manufacturers provided 50% of the estimated $5.3-million market for signal sources in 1973.

U.S. manufacturers supply about 20% of Germany's requirements of die classifiers, a market valued at almost $1.7 million in 1973. The presently modest market for probes, estimated at slightly over $300,000, is expected to grow by 15 to 20% annually for the next several years.

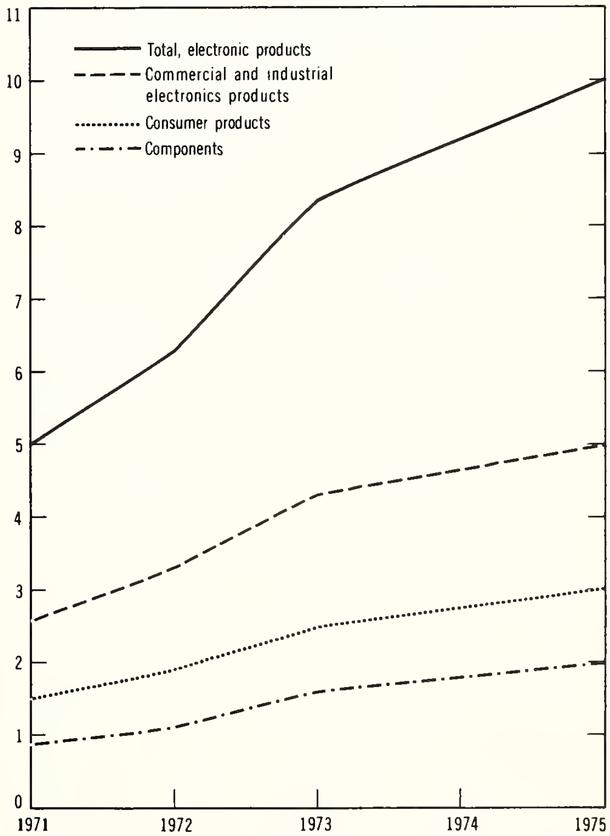
The Electronics Industry

Germany's electronics industry comprises about 220 firms, with a total labor force of 343,560. Total production of electronic products was estimated at $8.4 billion in 1973, up nearly 70% from $5 billion in 1971 (see graph). Trade sources predict a 9% average annual growth rate in production, which would bring the 1975 level to a value exceeding $10 billion.

Government spurs communications electronics.—Output of electronic communications equipment is expected to increase at an average rate of over 25% annually, topping $2 billion in 1977 from a

Germany: Output of electronic products, 1971, estimated 1972 and 1973, and projected 1975

(in billions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

1973 base of $893 billion. A major factor underlying this projected expansion is the Federal Postal authorities' plan to progressively change the electromechanical telephone system to an electronic one. Yearly expenditures on communications services are slated to exceed $3 billion in 1976, almost double the 1972 investments.

By 1975, about 10% of the new telephone installations will be of the electronic dial type, and by 1985 this proportion should reach 90%. With 1.6 million new installations annually, the slated yearly cost of the project is $500 million, including $171 million for equipment. The 11 million telephones now in operation will also be converted to electronic dialing.

The four leading German communications equipment manufacturers, Siemens, SEL Standard Elektrik, Deutsche Telephonwerke & Kabelindustrie (DTK), and Telefonbau und Normalzeit (TN), will be awarded the pertinent contracts. Siemens and SEL probably will receive 60% of the contracts, and DTK and TN the remainder.

Another interesting development in the communications field is the introduction of the experimental 12 GHz television network. The Bundespost in Berlin plans to grant licenses for the operation of commercial 12 GHz television and will construct the necessary transmitters and relay stations in metropolitan areas. CAT-TV may also be introduced soon. In addition, a 12 GHz television-radio satellite is under study by the European Space Research Organization. The goal of this project is to enable direct reception of intercontinental television programs.

Color television sales booming.—Led by such major domestic firms as Grundig Werke GmbH, Philips Elektronik, AEG-Telefunken A/G, and Fernseh GmbH, Germany's entertainment electronics industry is expected to sustain 10 to 15% annual increases in production between 1973 and 1977. Increased leisure time and higher income levels are two major factors behind the growth of this market. Output by value rose from $1.5 billion in 1971 to $2.5 billion in 1973. Total production in this segment of the electronics industry in 1975 should exceed $3 billion.

Production of color television receivers in setting new records. In 1971, only 1.05 million of the 3.05 million television sets sold by German producers were color. Current annual production is approximately 2 million color sets; output is expected to reach 2.4 million in 1974. Sustained consumer demand should enable the industry to maintain this level for the next 4 or 5 years.

Computer production expected to double.—The country's computer production is expected to reach $3.6 billion in 1978, double the 1973 level. The greatest growth should occur in output of process computers and other small units.

Siemens, Telefunken Computer GmbH, and Nixdorf Computer A/G are the leading German-owned manufacturers of computers. Siemens' products are said to account for 16% of Germany's computer population, the company's sales were valued at $299 million in 1972. Its products cover the entire range of electronic data processing (EDP) equipment with the exception of commercial minicomputers.

Telefunken Computer, a joint venture of AEG-Telefunken and Nixdorf, reported sales of $33 million in 1972, its first year of operation. The firm specializes in the production of large computers, particularly those suited to technical and scientific applications.

Nixdorf Computer, the country's leading manufacturer of small computers for commercial use, had sales valued at $126 million in 1972. Several U.S. computer companies, including IBM and Honeywell, have manufacturing subsidiaries in Germany and also are leading producers.

Research in electronic data processing is funded by the Federal Government to assist German industry in meeting foreign competition. A projected $321 million will be allocated by the Government in 1975 for EDP research and development. This is nearly double the 1973 estimated investment of $175 million. It is likely that Federal support will concentrate on software development in the future because several large computer users have requested better software support for private and public services.

Industrial electronics shows steady growth.—An 11 to 13% average annual growth rate for Germany's industrial electronic equipment production is anticipated during the next 5 years. The leading manufacturers, which together hold more than 50% of the market, are: Measuring Instruments; AEG-Telefunken; Siemens; Honeywell; Hartmann & Braun A/G; Grupp-Atlas Elektronik; Hewlett-Packard; Metrawatt GmbH; Brown, Boveri & Cie A/B (BBC); and Philips.

Electronic equipment increasingly is being incorporated into automobiles. Volkswagen, for example, has electronic devices built into several of its models to facilitate testing by diagnostic centers, and Ford and Opel are expected to follow suit.

Alternators, blinkers, clocks, and fuel injection systems already contain electronic equipment, and widespread use of electronic ignition systems is anticipated. The enforcement of stricter air-pollution control laws also will affect the industrial electronics market.

Altogether, production of electronic products for use by Germany's automotive industry should be four times its current volume by 1977.

Outlook optimistic for components.—Rising from a 1971 base of $905 million, German production of components reached an estimated value of $1.6 billion in 1973 and should approach the $2 billion level in 1975. Output of passive components in 1971 was valued at $365 million, or over one-third of that year's total component production.

Because more than 60% of all components manufactured domestically are sold within Germany, the level of output is highly dependent upon the demand for locally produced electronic products. The buoyant market forecast for electronic consumer goods and communications equipment, coupled with steady growth in sales of computers and process instruments, should ensure an expanding level of component production.

The major component manufacturers are Siemens, with 20% of the domestic component market; Texas Instruments Deutschland, 15%; Valvo GmbH, 12.5%; Intermetall, 10%; and AEG-Telefunken, 7.5%.

Although the largest firms in the German electronics field evidence a high degree of vertical integration, the industry as a whole is geared toward buying components for assembly. Siemens, AEG-Telefunken, SEL, Valvo, and BBC, for example, buy up to 50% of the components used in their end-products from outside sources and sell their own components to others.

Trade sources report that there are no announced plans for the formation of large, integrated companies or specialized suppliers of components. Agreements are in effect, however, between some U.S. companies and German firms, such as Motorola and AEG-Telefunken; Texas Instruments, Inc., and Siemens; and Fairchild Camera & Instrument Corp., and Valvo. The U.S. companies exchange their expertise for a preferential position with respect to substantial component purchases.

Labor costs encourage automation.—Spiraling wages and the scarcity of skilled workers are causing German firms to step up the use of capital-intensive production methods. Hourly wages in the industry rose by 16.8% in 1970, 14.6% in 1971, and 10.5% in 1972. An agreement negotiated with the Metal Workers' Union in January 1973 provides for an 8.5% increase.

Electronics Manufacturers' Profiles

A large German manufacturer of *active, passive, and electromechanical components* and all types of *modules* employs between 2,500 and 3,000 workers. Production amounts to about $160 million annually, with approximately 60% consisting of semiconductors and IC's; 20%, of printed circuits; and 20%, of other components.

The firm's total investment in production equipment is between $125 and $143 million and includes roughly equal proportions of automatic, numerically controlled, and computerized machinery. Annual expenditures on production equipment total approximately $3.6 million.

Roughly $13 million has been spent on highly specialized test equipment. The company invests between $1.4 and $1.8 million each year in test apparatus, of which 25% represents equipment produced in-house.

An established manufacturer of *passive components,* including *resistors, capacitors,* and *inductors,* as well as *integrated circuits,* and *solid state* and *modular assemblies,* has 400 employees and an annual production of $3.6 million. The company plans to branch out into the production of other components.

Most of the firm's $180,000 of production equipment was built in-house. It is primarily automatic and, although some of it is numerically controlled, none is computerized. The company also makes most of its own test equipment, with the exception of oscilloscopes, and tolerance and insulation testers.

A small German producer of *semiconductor diodes, transistors,* and *optoelectronic transducers (selenium rectifiers)* sells about half the $3.6 million output to entertainment electronics concerns and the other half to industrial electronic equipment manufacturers. The firm has a workforce of 250 and anticipates a 10 to 15% annual increase in sales. Most of the company's production equipment, valued at $161,000, and all its test equipment were built in-house.

A large communications equipment manufacturer produces *telephone sets; telegraph, telex,* and *intercommunication equipment; safety and alarm equipment; call systems;* and *sound and visual signaling equipment.* The company has about 8,000 employees and total annual sales of $214 million.

The firm buys all types of components and annually produces about $18 million worth of relays and thick film components, chiefly for in-house use. Production equipment for the manufacture of thick film components is computerized, but most other production machinery is numerically controlled.

Test equipment for printed circuits and electromechanical and other parts is made in-house. Semiconductors are tested automatically, and cable connections are tested on computerized equipment. Annual expenditures for test equipment normally run around $360,000.

Competitive Environment

Domestic manufacture of EIPT equipment in 1972 accounted for $56.7 million, or slightly over half the total market (see table 3). Manufacture by electronics firms for in-house use totaled $32.4 million. About $19 million of this amount consisted of production equipment and $13.4 million of test equipment. The large German electronics companies, such as AEG-Telefunken, Intermetall, Siemens, Valvo, and SEL, developed their own special equipment as they entered the field and use some machinery produced in-house in assembly and testing operations. It is estimated that 50% of all semiconductor and IC production equipment and 50% of all interfacing equipment used in Germany is made in-house. In addition, about one-third of the equipment used to produce passive components and one-fourth of that used to manufacture printed circuits are fabricated for in-house use by electronics firms.

Independent commercial suppliers of EIPT equipment soild $18.4 million in production equipment and $5.9 million in test equipment during 1972. The German EIPT equipment industry is generally most competitive in wire interconnecting apparatus, high-vacuum equipment, and heavy machinery for drilling, stamping, pressing, and packaging. Domestic companies are also competitive producers of such equipment as drying ovens and clean boxes.

Table 3.—Germany: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced			
by end-user	19.0	13.4	32.4
by other firms	18.4	5.9	24.3
Imported			
from the U.S.	23.1	19.1	42.2
from other countries	6.3	1.9	8.2
Total	66.8	40.3	107.1

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on German trade source estimates.

There are only a few American subsidiaries manufacturing EIPT equipment in Germany. These include Gardener Denver, which produces drilling machines, Hewlett-Packard, Beckman Instruments, Inc., and Texas Instruments.

American equipment in demand.—German imports of American EIPT equipment are forecast to rise from $42.4 million in 1972 to $112 million in 1974 (see table 4). Purchases of U.S. equipment in 1977 are expected to top $187 million. Of this projected total, production equipment should account for $80 million, an almost fourfold increase over the country's 1972 imports of such equipment from the U.S. Imports of U.S. test apparatus are anticipated to reach $107 million in 1977, representing a 40% average annual increase over 1972, when purchases totaled $19.1 million.

The country's needs for the most modern equipment are rising steadily and Germany will look increasingly to foreign suppliers to meet its requirements. German manufacturers are replacing older EIPT machinery, which was often built in-house, with high-priced automated systems. The specialization of components, plus steep labor costs, are the major factors influencing domestic manufacturers to further automate their operations.

The German market has been too small to warrant local manufacture of highly specialized computer-controlled production and test equipment. As a result, U.S. suppliers of such equipment face little competition from German or third-country suppliers, and the outlook for immediate and long-term sales of specialized U.S. machinery is excellent.

Table 4.—Germany: Imports from the U.S. of electronics industry production and test equipment, 1972, and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	23.1	57.2	80.2
Test equipment	19.1	54.9	107.2
Total	42.2	112.1	187.4

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on German trade source estimates.

Germany's imports of EIPT equipment from other countries amounted to $8.2 million in 1972, of which $6.3 million represented production equipment and $1.9 million was test apparatus. The Swiss and British are considered highly efficient manufacturers of high-vacuum, laser, and test equipment. Such British companies as Edwards Hochvacuum; Culton Instruments; Dynachem (UK), Ltd.; Fry's Metals, Ltd., and Sericol Group, Ltd., are represented in Germany. Swiss exporters include Balzers A/G, Ciba-Geigy, Contiflex, Kistler Instruments, and Posalux A/G. The Dutch company, Philips, is a major supplier of measuring instruments. The French Cit-Alcatel sells density control testers and wire-wrapping machines. Other French companies active in the market include BBT, Piezo Ceram Electronique, and Comatel. The Italian firm Resco sells printed circuit production equipment.

Tariff rates on EIPT equipment imported from the United States range from 5.5% on furnaces and drying ovens to 13% on photocameras, photoprinters, and ultrasonic electronic test and measuring equipment. A value-added tax of 11% is also assessed.

Additional information concerning import duties may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1015, Main Commerce Building, Washington, D.C. 20230.

Technical Requirements

The characteristics of Germany's electric power supply are 220/380 volts, 50 hertz, single and 3-phase, 2 and 4 wires. The metric system of weights and measures is used. Additional information on Germany's technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

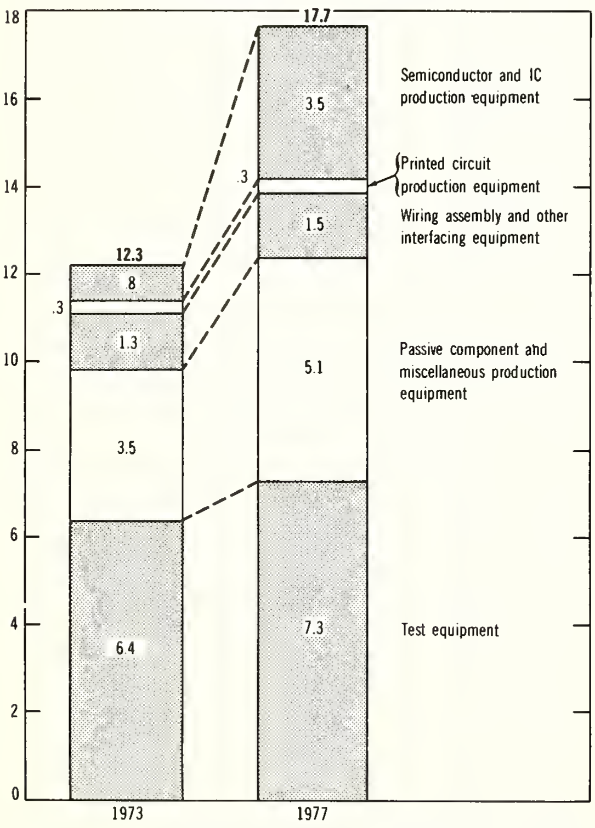
The following market research survey is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M, Main Commerce Building, Washington, D.C. 20230:

"The Market for Electronics Industry Production and Test (EIPT) Equipment in Germany," DIB 74-01-510, May 1973.

Hong Kong

Hong Kong's dynamic electronics industry is expected to increase production by 80% during the 1972-75 period, going to $617 million. Capital investment in electronics industry production and test (EIPT) equipment is being stepped up to meet the rising demand for electronic goods, to improve product quality, and to increase efficiency in the face of soaring labor costs and high labor turnover.

As a result, Hong Kong's EIPT equipment market, estimated at $12.3 million in 1973, should expand at an average annual rate of 9.5% to $17.7 million in 1977 (see table 1).



Hong Kong: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Hong Kong trade source estimates.

American exporters should benefit from the growing trend toward high technology production methods and are expected to capture about 30% of the total Hong Kong EIPT equipment market in 1977 with sales of about $5 million. This will be a considerable improvement over the American competitive position in 1972, when the U.S. share of the market was 13%, or $1.3 million.

Hong Kong's EIPT equipment imports from other foreign countries exceeded $6.8 million in 1972, accounting for about 65% of the total market. Domestic sources contributed 22%, or over $2.2 million, in production and test equipment for the electronics industry. Of the local production, about $1.6 million worth was fabricated by electronics companies for in-house use and the remaining $690,000 came from small commercial suppliers.

Selected Sales Opportunities

A market survey recently conducted in Hong Kong for the Office of International Marketing (OIM), U.S. Department of Commerce, reveals highly favorable sales opportunities for American producers of the following types of EIPT equipment:

Production Equipment

- Dicing machines
- Sealers
- Furnaces
- Vacuum pumps
- Bonding equipment
- Wafer probing equipment
- Sputtering equipment
- Ovens
- Component inserting and sequencing machines

Hong Kong—Selected Indicators (1972)

Gross national product:	**$4.06 billion**
Population:	**4.1 million**
Total country imports:	**$3.86 billion**
Total country exports:	**$3.44 billion**
Exchange rate (October 1973):	**5.085 Hong Kong dollars = US$1**

- Ultrasonic welding equipment
- Soldering systems
- Color-coding machines
- Crimping and cutting machines
- Cutters
- Terminal-installing machines
- Cable harness equipment
- Vapor degreasers
- Automatic riveting machines
- Coil winders

Test Equipment

- Integrated circuit test equipment
- Transistor test equipment
- Diode test and classifier equipmen
- Resistor test equipment
- Wiring test equipment
- Environmental test chambers
- Wafer probing equipment
- Multitesters
- Signal generators
- Oscilloscopes

Semiconductor and integrated circuit production equipment.—Hong Kong's market for semiconductor and integrated circuit (IC) production equipment is expected to grow at an average rate of almost 45% a year, rising to nearly $3.5 million in 1977. This represents a marked acceleration in demand in contrast to the trend evidenced during the 1971-1973 period, when annual sales declined from $904,000 to an estimated $802,000. The projected growth is based on an expected rise in the demand for components from radio manufacturers and an increase in 1974 in the number of local firms producing IC's.

Hong Kong's need for a variety of production machines will increase appreciably with the expected surge in the market for integrated circuits. U.S.-made equipment for manufacturing integrated circuits holds a clear competitive lead in the Hong Kong market. In particular, American wafer probing and bonding equipment, dicing machines, and sealers—all regarded as superior in design, quality, and reliability—will be in demand.

A number of Hong Kong factories have been using ovens that were either locally fabricated or imported from China, but are now turning to U.S.-made automatic and high-capacity equipment in order to increase efficiency. American conveyor furnaces, considered by Hong Kong manufacturers to be the best available, are used extensively in semiconductor and IC production operations, and U.S. suppliers should find a continuing market for these products.

Printed circuit production equipment.—The rising cost of labor in Hong Kong is spurring investment in more automated machinery for printed circuit board production. This market climbed moderately from $200,000 in 1971 to $260,000 in 1973 and should reach $303,000 in 1977.

American-made component inserting machines sell well, despite competition from German suppliers. The American machines offer a wider range of application and are preferred by the subsidiaries of U.S. companies, which constitute a majority of the end-users. Efforts to produce higher quality products, coupled with the ongoing trend toward more capital-intensive methods, will boost overall demand for component inserting machines.

Wiring assembly and other interfacing equipment.—Stepped-up production of products requiring winding and wire handling equipment increased demand in this category from $1.2 million in 1971 to $1.35 million in 1973. The market is expected to top $1.5 million in 1977.

The need to cut labor costs is an especially important factor contributing to the trend toward using more automated soldering systems and crimping and cutting machines. Most Hong Kong manufacturers presently employ manual soldering techniques but some are beginning to institute more advanced methods. U.S.-made soldering equipment, even of the simplest type, is preferred because of its reliability. American crimping and cutting machines are considered to be exceptionally durable and include a number of automated features not found in other equipment. There is also a growing demand for

Table 1.—Hong Kong: Consumption of electronics industry production and test equipment, 1971-1973
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	0.90	0.73	0.80
Printed circuit production equipment	.20	.21	.26
Wiring assembly and other interfacing equipment	1.20	.94	1.35
Passive component and miscellaneous production equipment	3.39	4.57	3.52
Test equipment for production/ inspection of electronic products	3.00	3.95	6.40
Total	8.69	10.40	12.33

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Hong Kong trade source estimates.

American terminal-installing machines, which are noted for giving a better finish than those manufactured in other countries.

Passive component and miscellaneous production equipment.—Hong Kong's market for passive component production equipment is predicted to rise to an estimated $3.5 million in 1973 to over $5.1 million in 1977. Demand for this equipment has fluctuated since 1971 but is expected to climb at a steady pace from 1974 through 1977 as factories replace and upgrade existing facilities.

Domestic manufacturers of coils and other passive components will require faster and more highly automated winders in order to meet production requirements and reduce labor costs. Equipment that can wind 10 to 20 coils simultaneously while monitored by a single operator is especially needed. American suppliers should do well in this market in spite of keen Japanese competition.

Test equipment for production/inspection of electronic products.—The market for test equipment increased sharply from slightly over $3 million in 1971 to about $6.4 million in 1973. Efforts to upgrade products in Hong Kong's large radio industry should create a $7.3-million test equipment market by 1977. Two concurrent factors, the need to improve the quality of radios to meet stiff international competition and the need to increase production efficiency to counter soaring labor costs, are making automated testing systems more necessary to Hong Kong manufacturers. U.S. producers are expected to find excellent sales opportunities in the expanding market for advanced, sensitive automated test and classifier equipment.

The recent emphasis on raising the quality of radio receivers should have a salutary effect on sales of signal generators and multitesters. Hong Kong manufacturers find U.S.-fabricated machinery of both types to be outstanding in accuracy, reliability, and flexibility.

American environmental test chambers are widely used and will continue to be since they are more durable than those produced elsewhere and their use is often specified by U.S. purchasers of Hong Kong's electronic products. Although American-made oscilloscopes face strong competition from those produced in Japan, U.S. equipment is considered superior and will continue to be sought for more demanding test operations.

The Electronics Industry

Hong Kong's Electronics Industry—Basic Data (1972)

Total value of production:	**$346 million (est.)**
Number of manufacturers:	**305 (est.)**
Industry labor force:	**42,200 (est.)**
Output of selected products:	
Radios—	**$187 million**
Television receivers—	**$360,000 (1971)**
Semiconductors and IC's—	**$65.8 million**

Hong Kong's electronics industry comprises over 300 firms and employs approximately 42,000 workers. Electronics has been one of the fastest growing sectors in the economy, with the number of factories tripling and the labor force more than doubling between 1967 and 1973. There are about 200 firms specializing in radios, 10 in computer memories and peripherals, 9 in semiconductors and integrated circuits, 7 in electronic calculators, and numerous others in components. In all, about 60% of the factories and work force are engaged in producing finished electronic products, primarily radios; the remainder manufacture components.

Most of Hong Kong's electronics firms are small, particularly those producing radios. Approximately 45% of all factories had fewer than 50 workers in 1970; only 7% had over 500 employees. The majority of firms are accommodated in high-rise factory buildings in the Sanpokong and Kwun Tong districts in Kowloon and in the North Point, Chai Wan, and Aberdeen districts on Hong Kong Island.

A substantial number of firms are in residential areas in other Kowloon districts, and a few companies are in the New Territories. Total capitalization of all electronics firms was placed at $13.9 million in 1970 by Hong Kong's Commerce and Industry Department and is presently thought to be on the order of $24.3 million.

Foreign participation is substantial.—Although an estimated 70% of the electronics firms are locally owned, foreign influence is substantial because most larger factories are affiliated with overseas concerns. There are nine major radio manufacturers which together account for approximately 45% of all radio production. Only three of the nine are wholly owned by Hong Kong interests: Atlas Electronics Corporation, Ltd.; Asia International Electronics, Ltd.; and Trans-World Electronics, Ltd. Three are subsidiaries of U.S. firms: Arvin (Hong Kong), Ltd.; Sylvania Far East, Ltd.; and Electronic Industry, Ltd.

The value of the monthly production of Sylvania and Electronic Industry (a subsidiary of the General Electric Company), for example, averages about $1 million each, all destined for export. EIPT equipment expenditures in 1972 amounted to $80,000 for Sylvania and $100,000 for Electronic Industry. Herald Electronics, Ltd., is a joint venture between a local company and an American concern, and the other two major radio producers, Sanyo Electric, Ltd., and Realtone Electronics, Ltd., are affiliates of other foreign-owned companies.

Six of the nine firms engaged in semiconductor and IC production are subsidiaries or affiliates of American firms. Only two companies, Century Electronic, Ltd., and Semiconductor Devices, Ltd., are locally owned. The remaining firm, Electronic Devices, Ltd., is controlled by Philips of the Netherlands. Fairchild Semiconductor (Hong Kong), Ltd., one of the six U.S. subsidiaries, is considered to be the market leader. Three other American interests—Teledyne Semiconductors, Motorola Semiconductors (Hong Kong), Ltd., and Carter Semiconductor, Ltd.—follow closely.

Nearly all of the 10 companies engaged in the production of computer memories and components are foreign-owned, again primarily by American firms. Among the largest American interests are Ampex Ferrotec, Ltd., with 3,000 employees, and Fabri-Tek (Hong Kong), Ltd., with 1,300 workers. Fabri-Tek's annual production of computer memories is valued at over $9 million, all of which is exported.

Over 40 firms in Hong Kong produce radio components and components for miscellaneous electronic products. These firms also include seven companies that are currently manufacturing electronic desk-top or pocket calculators. These are: R.J.P. Electronics; Promoters, Ltd.; Business Electronics, Ltd.; Harber Industries, Ltd.; Coltionic, Ltd.; Colex, Ltd.; and Realtone Electronics.

There is a discernible trend among the larger electronics manufacturers toward vertical integration from basic component production through final assembly operations. The majority of Hong Kong's electronics manufacturers, however, produce specialized end-products and purchase their components from commercial sources.

Production, exports rising steadily.—Hong Kong's Commerce and Industry Department estimated that total production for the electronic industry reached $152.6 million in 1969. Of this, 63% was accounted for by sales of finished products (mostly radios, TV receivers, and computer memories) and 37% by sales of components. By 1972, production had more than doubled to reach $346 million, of which $66 million was semiconductors and integrated circuits and $188 million was finished electronic products. A 20% rise in production is projected for 1974 and a further rise of 18% is forecast for 1975.

Output of semiconductor and integrated circuits was estimated at 714 million units in 1971 and 1.15 billion units in 1972. By value, 1973 production is estimated at $109 million, up 66% from $65.8 million in 1972, and is forecast to reach $197 million in 1975.

Radio production was valued at $176 million (39,000 units) in 1971 and was estimated at $218 million (nearly 47,000 units) in 1973. Trade sources predict that by 1975 almost 60,000 radios, valued at $278 million, will be produced annually.

Export figures indicate that production of computer memories increased sharply between 1969 and 1972. Hong Kong's overseas sales of computer memories totaled almost $29 million in 1970, more than a fivefold increase over the 1969 level of $4.6 million. By 1972, exports had nearly doubled to $50 million. Production of television receivers has fluctuated in recent years; it was valued at $360,000 in 1972, and by 1975 it should reach $900,000.

Hong Kong's electronics industry is heavily export oriented. About 89% of its production is exported, while 10% is sold locally and 1% is held in inventory. In the case of finished electronic products, approximately 97% of all production is for export.

Hong Kong's exports of electronic goods soared from $70.5 million in 1967 to over $308 million in 1972. Sales abroad of transistor radios, the largest single export item, have increased by an average of 37% annually during the past 5 years.

Major firms plan expansion.—Growth plans of leading electronics manufacturers are indicative of the expansion trends within the entire industry. Minerva Industries, Ltd., an American subsidiary producing components, increased its expenditures on new equipment by 100% between 1971 and 1972 and plans to double its 1972 capacity by 1974. Core Memories (Hong Kong), Ltd., a U.S.-owned producer of memory stacks and memory systems for computers, increased its total production capacity by 200% in 1972 and spent $100,000 on new equipment. Core Memories plans to expand its production by 10 to 20% a year. Output in Hong Kong's electronics industry was expected to grow by 60% in 1973, with emphasis on higher quality radios and greater diversification of product lines.

Government supports electronics research.—The Hong Kong Government has a *laissez-faire* policy toward industry and business. Its major involvement with the electronics industry is in the areas of education and research; e.g., through support of the engineering departments at the University of Hong Kong and the Chinese University of Hong Kong. The former offers a bachelor degree program in electrical engineering.

Research projects underway at the University of Hong Kong include: the design of a microwave receiving system enabling separate communities over a large area to receive direct television broadcasts via a communications satellite; and the measurement of complex permissibility of liquids at microwave frequencies using an open resonator.

A small fabrication laboratory for semiconductor devices has been installed at the Electronics Department of the Chinese University of Hong Kong Research is being conducted on the spin-on technique in diffusion doping and on oxide and insulator growth on semiconductors, particularly on silicon.

Component Manufacturers' Profiles

Semiconductor Devices, Ltd., employs approximately 800 workers to produce *transistors* and *integrated circuits*. The company exports about 95% of its total production, primarily to the United States. About 60% of its EIPT equipment purchases over the last several years have been imported from the United States. An additional 20% was purchased from other countries, 10% was fabricated in-house, and 10% was bought locally.

U.S. equipment in use in 1973 included products from Kulicke & Soffa Industries, the American Optical Corporation, Tempress, Inc., the Kras Corporation, the Blue M Engineering Company, Polymold, and the Hull Corporation. Expenditures for equipment during 1972 amounted to $300,000. Purchases in 1973 and 1974 are expected to be between $50,000 and $100,000.

The shortage of trained labor and high labor turnover have increased the firm's need for laborsaving devices and machines that are easy to operate. Semiconductor Devices is especially interested in purchasing bonding equipment, dicing machines, furnaces, leak detectors, microscopes, sealers, transistor test equipment, wafer probing equipment, and oscilloscopes. The company's movement toward automation is considered typical of domestic firms engaged in semiconductor production.

Electronic Sales, Ltd., specializes in *power transformers* and, more specifically, *intermediate frequency transformers for AM/FM radios*. The company employs 100 workers and its annual output ranges between $300,000 and $500,000. The factory was established in 1972 and recently obtained Underwriters Laboratory (UL) approval so that its products may be sold in the United States. Company officials report that $20,000 was spent on equipment in 1972 and plans for 1973 and 1974 call for expenditures of approximately $5,000 each year.

Electronic Sales is adopting automation techniques to cut costs and compensate for scarce labor. The company is contemplating purchases of core inserting machines and an automated coil winder.

End-Product Manufacturers' Profiles

Atlas Electronics Corporation, Ltd., was one of the first, and is among the largest, *radio* producers in Hong Kong. The firm has a manufacturing subsidiary in Singapore and plans to expand its operations to other parts of Asia. Atlas has diversified its product line both horizontally and vertically in recent years and, in addition to transistor radios, now supplies *cassette tape recorders, FM multiplex stereo sound equipment, transistors, polyvaricon tuning condensers, RF transformers, oscillator coils, electrolytic capacitors, input and output power transformers, and ferrite bars.*

The company's total fixed assets are valued at more than $2.8 million, of which $2.4 million is in factory premises and $463,000 in equipment. New equipment expenditures have been between $50,000 and $100,000 annually for the past several years. Atlas plans to invest $80,000 in breaking, die attaching, wire bonding, trimming, de-ionizing, transfer molding, impregnation, and test equipment in order to move toward more sophisticated production of semiconductors.

Following an increase in sales from $11.7 million in 1971 to $19 million in 1972, Atlas began intensifying product development and planning to introduce a broader line of products. Spiraling wages and the relative scarcity of labor, coupled with the growing sophistication of its product lines, have increased the firm's needs for more complex and labor saving equipment.

Alco Electronics, Ltd., with 450 workers, presently specializes in *radio receivers* and plans to branch out into *cassette tape players* and *8-track stereo tape players*. The firm spent about $30,000 for the purchase of EIPT equipment in 1972.

Alco uses an oscilloscope made by Hewlett-Packard and a solder pot from the Dee Electric Company, both U.S. firms. Most of the other equipment in use is from such Japanese companies as Trio Electronics, Inc., Meguro Danpa Sokki K.K., Sanwa Electric Instrument Company, Ltd., Yamato, and the Kikusui Electronics Corporation. The company also has some machinery from Radiometer A/S of Denmark.

Future plans call for the purchase of automatic soldering systems, crimping machines, cutters, transistor test equipment, oscilloscopes, ampere meters, voltmeters, and signal generators. Like other factories in Hong Kong, Alco is faced with rising labor costs and employee turnover problems and would like to introduce more automated methods of production, particularly in its crimping, cutting, and soldering operations.

Competitive Environment

There are no major manufacturers in Hong Kong that specialize in electronics industry production and test equipment. In 1972, over two-thirds of the locally produced EIPT equipment, or $1.6 million, was made by electronics firms for their own use. Inhouse manufacture of production equipment and test apparatus amounted to $970,000 and $590,000, respectively (see table 2). Small commercial suppliers, working mainly on a custom-order basis in production machinery, produced $690,000 of EIPT equipment in 1972.

Kulicke and Soffa Industries has a branch in Hong Kong that manufactures some spare parts, such as capillaries for bonding equipment. The firm's

Table 2.—Hong Kong: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	0.97	0.59	1.56
by other firms	.65	.04	.69
Imported:			
from the U.S.	.32	.99	1.31
from other countries	4.51	2.33	6.84
Total	6.45	3.95	10.40

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Hong Kong trade source estimates.

product line is limited, however, and it continues to import most of its equipment from the United States or Germany. The Kras Corporation plans to produce molding equipment for the electronics industry in Hong Kong. A number of local firms make presses, riveting machines, and other basic equipment used by the electronics industry.

Hong Kong's larger electronics firms have begun fabrication and design of more sophisticated EIPT equipment for their own use. Ampex Ferrotec, for example, won the 1973 Hong Kong Governor's Award for its automatic array stack tester design. The Talaka Company, a Japanese-owned firm, assembles bonders, die attachers, and welders from parts and microscopes imported from Japan. The capacity of this small operation is limited to 60 sets a month on a custom-ordered basis.

Of the $1.3 million of EIPT equipment imported from the United States in 1972, $320,000 represented production equipment and $990,000 represented test devices (see table 3). An optimistic outlook prevails for sales of U.S. equipment as the expanded output of electronic products increases the demand for complex and unique production and test apparatus. By 1974, imports from the United States should approach $3 million. A substantial rise in the U.S. share is predicted for 1977 when American suppliers should capture almost 30% of the $18-million market; U.S. sales of production equipment will probably be over $2 million and sales of test equipment almost $3 million.

Table 3.—Hong Kong: Imports from the U.S. of electronics industry production and test equipment: 1972 and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	0.32	1.12	2.0
Test equipment	.99	1.86	3.0
Total	1.31	2.98	5.0

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Hong Kong trade source estimates.

Manufacturers in other countries supplied Hong Kong with nearly $4.5 million in production equipment and $2.3 million in test equipment in 1972. A number of Japanese firms are active in the Hong Kong market, including Trio Electronics, Inc., the Sanwa Electric Instrument Company, Ltd., the Kikusui Electronics Corporation, the Tanaka Electronics Ind. Corporation, Ltd., and Olympus. Suppliers from the United Kingdom include Marconi, Telequipment, Advance, AVO, and EMI. Three German competitors are Rhode & Schwarz, Leitz, and Heraus. The Danish firms, Radiometer A/S and Bruel Rjoer, and the Dutch company, Philips, are also represented.

Hong Kong is a free port. There are no customs duties, taxes, or other barriers to the importation of EIPT equipment. Additional information concerning import regulations may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Room 5217 Main Commerce Building, Washington, D.C. 20230.

Technical Requirements

The electrical power supply in Hong Kong is 200 volts, 50 hertz, for normal use and 346 volts, 50 hertz, for industrial use. Both the British and metric systems of weights and measures are used, although the metric system is becoming more widely accepted. Detailed information on technical requirements may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

The following market research survey is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M Main Commerce Building, Washington, D.C. 20230:

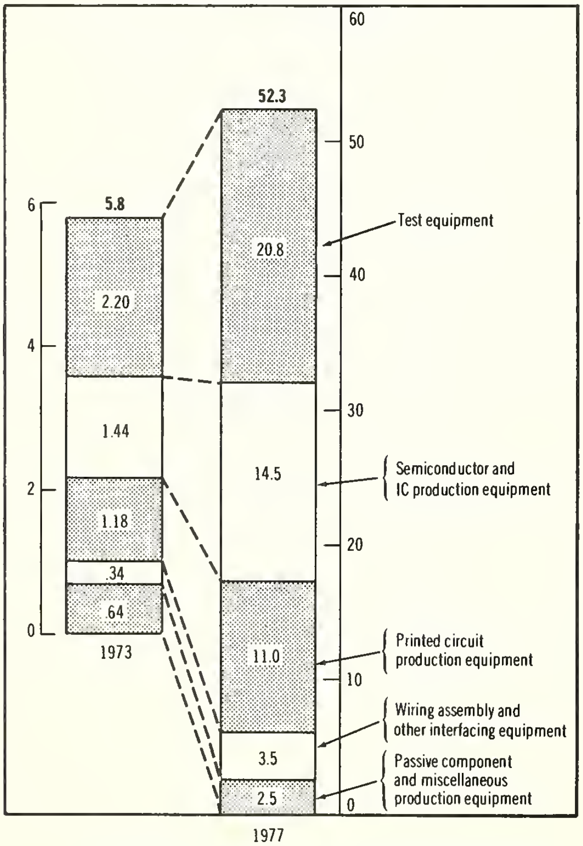
"The Market for Electronics Industry Production and Test Equipment in Hong Kong," DIB 74-01-511, June 1973.

Hungary

Hungary's fourth Five Year Plan (1971-75) accords high priority to the rapid expansion and modernization of the country's electronics industry. Hungary expects to more than double its present $100-million export market in consumer electronics and telecommunications equipment by 1977. Four large-scale investment projects emphasizing computer-controlled systems and fully automated factories were scheduled to begin in 1973 and are expected to generate a sizable demand for production and test equipment.

Hungary: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Hungarian trade source estimates.

Total consumption of electronics industry production and test (EIPT) equipment in Hungary climbed from $3.8 million in 1972 to an estimated $5.8 million in 1973 and is projected to exceed $14 million in 1974 (see table 1). The Hungarian market is estimated to top $52 million by 1977 and could be one of the fastest growing EIPT equipment markets in Europe.

Hungarian purchases of American-made EIPT equipment were estimated at $3.25 million in 1973 and represented 56% of the total market. During the rapid expansion of this equipment market that is anticipated to take place between 1973 and 1977, U.S. suppliers are expected to maintain their market share, with imports from the United States forecast to approach $30 million in 1977.

Locally produced EIPT equipment accounted for 26% of the total market in 1973, with $430,000 worth produced by end-users for in-house use and $1.07 million produced by commercial EIPT equipment manufacturers. Foreign firms from countries other than the United States accounted for the remaining 18% of the market in 1973 with imports valued at $1.05 million.

Selected Sales Opportunities

Hungary's industrial labor force decreased by almost 1.5% in 1972, reflecting the country's growing manpower shortage. Consequently, planned production increases in the electronics industry can be realized only by increasing productivity through investment in modern production and test equipment.

Moreover, the decreasing budgetary commitments to research and development in EIPT technology

Hungary—Selected Indicators
(1972)

Gross national product (1971 prices):	**$17.7 billion**
Population:	**10.4 million**
Total country imports:	**$3.15 billion**
Total country exports:	**$3.29 billion**
Exchange rate (official):	**10.81 forints=US$1**

foreshadow a growing gap between Hungary's EIPT equipment requirements and the ability of domestic producers to fulfill them. The resulting demand for imported EIPT equipment indicates that very favorable sales prospects can be found in Hungary for U.S. manufacturers of such equipment.

The following American-made equipment is exportable under U.S. validated or general licensing procedures and has been identified by a recent market survey conducted for the U.S. Department of Commerce, Office of International Marketing, as having good sales prospects. Additional information regarding U.S. export controls for EIPT equipment may be obtained from the U.S. Department of Commerce, Bureau of East-West Trade, Office of Export Control, Washington, D.C. 20230.

Printed Circuit Production Equipment
- Cleaning equipment
- Chemical etching machines
- Photoresist systems
- Component inserting and sequencing machines
- Lead soldering equipment
- Low-pressure expoxy mold systems

Wiring Assembly and Other Interfacing Equipment
- Wire wrap systems
- Strippers
- Terminal installing equipment
- Cable harness equipment
- Connector assembly machines
- Card assembly machines

Passive Component and Miscellaneous Production Equipment
- Molding presses
- Glass-working machines
- Coil winders
- Transfer presses
- Precision machine tools

Test Equipment for Production/Inspection of Electronic Products
- Printed circuit board testers
- Environmental test chambers
- Oscilloscopes
- Digital voltmeters
- Digital frequency and time meters
- Programmable scopes
- Programmable pulse generators
- Programmable microwave power meters

American manufacturers should capture a sizable share of the Hungarian market for printed circuit production equipment. Hungary's rapidly expanding exports of computers, computer peripherals, and radio relay equipment, all of which rely on printed circuit components, are spurring printed circuit manufacturers to increase production.

Purchases of printed circuit production equipment increased from $800,000 in 1971 to $1.2 million in 1973 and are projected to more than double to $2.9 million in 1974. By 1977, the Hungarian market for printed circuit production equipment is forecast to approach $11 million, and U.S. suppliers are expected to steadily increase their share of this growing market.

From a value of $700,000 in 1973, representing 59% of the market, imports from the United States are forecast to rise to $1.8 million in 1974, or 62% of the market. U.S. firms are projected to supply 77% of the requirements for printed circuit production equipment in Hungary by 1977, registering $8.5 million in sales.

The market for wiring assembly and other interfacing equipment is promising, although smaller than that for printed circuit production equipment. Hungarian purchases of interfacing equipment increased from $170,000 in 1971 to an estimated $340,000 in 1973.

Trade sources predict that sales will climb to $870,000 in 1974 and will total $3.5 million in 1977. U.S. firms should claim about 45% of this market in the 1973-77 period; imports from the United States were projected to reach levels of $150,000 in 1973, about $400,000 in 1974, and $1.6 million in 1977.

The market for passive component and miscellaneous production equipment is expected to follow a similar pattern. Sales in this subcategory stood at $250,000 in 1971 and were estimated at $640,000 in 1973. Projections indicate that the market should reach $1.7 million in 1974 and $2.5 million in 1977. Imports of passive component and

Table 1.—Hungary: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	0.60	0.97	1.44
Printed circuit production equipment	.79	.84	1.18
Wiring assembly and other interfacting equipment	.17	.26	.34
Passive component and miscellaneous production equipment	.25	.38	.64
Test equipment for production/inspection of electronics products	1.17	1.39	2.20
Total	2.98	3.84	5.80

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Hungarian trade source estimates.

miscellaneous production equipment from the United States were estimated at $400,000 in 1973, are projected to reach $1.2 million in 1974, and should approach $2 million in 1977.

Sales of semiconductor and integrated circuit production equipment stood at $600,000 in 1971 and were estimated at $1.4 million in 1973. Demand is projected to climb to $3.1 million in 1974 and is forecast to exceed $14.5 million in 1977. Hungarian end-users have expressed a growing interest in intermetallic semiconductors and electronically controlled liquid-crystal display units to replace conventional display units in the production of color television tubes. Hungary is currently undertaking research on complex hybrid integrated circuitry based on thick and thin film and developing techniques in MSI and LSI.

At present, most Western nations are under obligation to control exports of items, such as production and testing equipment for diodes, transistors, and IC's, that may enhance the military capabilities of the Eastern European countries. The Coordinating Committee (COCOM)[1], the international security trade organization that selects the products which are normally denied export rights, makes exceptions when the equipment is destined solely for an obviously civilian end-user.

Test equipment for production/inspection of electronic products, including semiconductors and integrated circuits, accounts for 38% of the Hungarian EIPT equipment market. Sales in this category reached $1.2 million in 1971 and were estimated at $2.2 million in 1973.

Demand for test equipment will remain great, with the potential market projected at $5.7 million in 1974 and $21 million in 1977, the latter an almost tenfold increase over the 1973 level. The booming demand for a wide range of test equipment is a result of the increasing emphasis Hungarian electronics manufacturers have placed on quality. Hungarian manufacturers hope to mass-produce high-technology hybrid electronic circuits, and these will require extensive testing to maintain quality control. Moreover, consumer electronic products must meet rigorous standards to satisfy Western buyers and to please the increasingly sophisticated domestic consumer.

American test equipment found in the local market is considered superior in design and performance to equipment produced by other countries or by domestic manufacturers. Hungarian imports of American-made test equipment were estimated at $1 million in 1973.

The Electronics Industry

Hungary's fourth Five Year Plan (1971-75) calls for investments totaling $630 million in the country's communications system. Specific projects include the completion of domestic links in an international cable network, the building of regional automatic switching networks, the construction of shortwave radio stations, and the establishment of a national color television transmission network. Hungary's electronics industry has reacted to the stimulus of this government initiative and is engaged in an active expansion program. Manufacturers are also seeking to increase productivity to counter a serious manpower shortage. There will therefore be increased demand for imports of advanced EIPT equipment.

Hungary's Electronics Industry—Basic Data
(1972)

Number of manufacturers:	**21**
Output of selected products (units):	
Television receivers—	**355,000**
Radios—	**250,000**
Tape recorders—	**50,000**

Industry is large and diversified.—The electronics industry in Hungary consists of 21 manufacturing enterprises. Nine of these primarily produce telecommunications equipment, nine manufacture electronic products, and three manufacture both. Four companies account for all of Hungary's production of components, and five companies produce three-fourths of the country's electronic end-products (see table 2).

Total employment figures for Hungary's electronics industry are not available, but partial statistics indicate that the five firms responsible for 35% of the country's output of finished products and 90% of its components employed approximately 8,000 workers in 1973 (see table 3).

The electronics industry manufactures a wide range of products, from telephone equipment, computers, and EIPT equipment to tape recorders, television sets, and radio communications systems. Annual production of television sets and tape recorders is expected to double between 1972 and 1977, while radio production should increase by 20%.

Many of the industry's products are destined for foreign markets; exports of electronic and telecommunications equipment totaled $107 million in 1972. The most important exports were: data transmission equipment, $10.6 million; microwave equipment, $16.1 million; television sets, $9.2 million; and central telephone exchange systems, $38.8 million. Total Hungarian exports of electronic and telecommunications products are forecast to exceed $250 million in 1977.

Several foreign companies are participating in the industry's efforts to increase production for ex-

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[1] Includes Japan and all member states of NATO except Iceland.

Table 2.—Hungary: Production shares of leading manufacturers of electronic components and end products, 1973

Enterprise	Share of total domestic output (%)
End-Product Manufacturers	
United Incandescent Lamp and Electrical Co., Ltd. (Tungsram)	25
Orion Radio and Electrical Enterprise (Orion Radio es Villamossagi Vallalat)	15
Electronic Measuring Equipment Works (Elektromechanikai Gyara—EMG)	15
Industrial Research Institute for Electronics (Hiradastechnikai Ipari Kutato Intezet—HIKI)	10
Electromechanical Enterprises (Elektromechanikai Vallalat—EMV)	10
Total	75
Component Manufacturers	
Remix Radiotechnical Enterprise (Remix Radiotechnikai Vallalat)	40
Telecommunications Enterprise (Hiradastechnikai Anyagok Gyara—HAGY)	25
Industrial Research Institute for Electronics Hiradastechnikai Ipari Kutato Iitezet—HIKI)	20
Kontakta	15
Total	100

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

port. Cooperative agreements have been signed with numerous foreign firms, including Thomson CSF of France, Ericsson of Sweden, Fernseh GmbH of Germany, and Bowmar of the United States

Industry boom to continue.—The Hungarian electronics industry has embarked on a major expansion and modernization program to satisfy escalating demand in foreign and local markets and to implement the economic policy directives of the country's current Five Year Plan, which specifically calls for the introduction of advanced production techniques in the electronics industry.

Three new electronics production facilities are under construction and plans and designs for five additional plants have been approved. These new facilities will incorporate the most advanced production techniques. Their production will be devoted to telephone and coaxial communications cables, microwave communications equipment, computers and peripheral equipment, television test and monitoring equipment (for both black and white and color), semiconductors and microcircuits, and process, assembly, and test equipment.

Most of Hungary's major electronics enterprises have announced ambitious expansion plans. HIKI plans to expand its research and development facilities and bring its pilot plant to full production capacity. Remix and HAGY have announced plans to increase components production through the automation of assembly lines. EMV is currently expanding its manufacturing plant by almost 55,000 square feet.

Production for export will more than double during the 1973-77 period. Hungary exported 125,000 black and white television sets in 1972; by 1977, exports of black and white sets should reach an annual level of almost 400,000. The first exports of color television sets are scheduled to begin in 1974 and are projected to grow to about 50,000 sets per year by 1977.

Foreign demand for other telecommunications equipment, such as data transmission equipment and central telephone exchange systems, and for medical electrical equipment, electronic measuring apparatus, and microwave equipment is forecast to generate Hungarian exports of about $140 million annually by 1977.

Hungarian electronics enterprises are striving to increase productivity to counter the country's manpower shortage and continually rising wages by investing in highly advanced automated EIPT. Certain enterprises are also considering some degree of vertical integration.

Rather than continue to rely on imports of specialized components, electronics enterprises are building plants to manufacture their own components. Thus, while component imports will increase only gradually, imports of component production equipment are expected to grow rapidly.

Component Manufacturers' Profiles

The Industrial Research Institute for Electronics (Hiradastechnikai Ipari Kutato Intezet—HIKI), founded in the early 1950's through the amalgamation of Hungary's electronics research laboratories, is one of the country's largest electronics enterprises. HIKI produces 20% of domestically produced components and 10% of the industry's end-products. The

Table 3.—Hungary: Electronics enterprises employment, 1973

Enterprise	Workers
Orion Radio and Electrical Enterprise (Orion Radio es Villamossagi Vallalat)	4,300
Industrial Research Institute for Electronics (Hiradastechnikai Ipari Kutato Intezet—HIKI)	2,000
Electromechanical Enterprise (Elektromechanikai Vallalet—EMV)	1,000
Remix Radiotechnical Enterprise (Remix Radiotechnikai Vallalat)	400
Telecommunications Enterprise (Hiradastechnikai Anyagok Gyara—HAGY)	250
Total	7,950

Source: U.S. Department of Commerce, Bureau of International Commerce (OIM) market research study.

Institute produces EIPT equipment and components, including *integrated circuits, R/C components,* and *microelectronic circuits.* Considerable research is being devoted to developing the production technology for *optoelectronic devices, controlled liquid-crystal display units, intermetallic semi-conductors,* and *medium- and large-scale integration.* HIKI's plans include concentrated research in complex hybrid integrated circuits and tantalum thin-film hybrid circuits. The Institute employs some 2,000 personnel, 500 of whom are in research and development, 500 in component production, and 500 in end-product manufacturing.

HIKI plans to expand its present research and development facilities and to add four new production plants for components and end-products by 1977.

Hungary's largest component manufacturer is *The Remix Radiotechnical Enterprise* (Remix Radiotechnikai Vallalat) in Budapest. Remix produces approximately 40% of the total domestic output of components. It is particularly well known for its high quality *wire-wound resistors, capacitors, potentiometers,* and *thick and thin film resistors.* Other products include *R/C components* and a wide range of *integrated circuits.*

Remix, with its 400 employees, plans to increase its production of semi-conductor based linear and MOS integrated circuits, thick and thin film integrated circuits, and discrete passive components.

The Telecommunications Enterprise (Hiradastechnikai Anyagok Gyara—HAGY) is Hungary's largest manufacturer of computer components; it produces one-fourth of the country's total output of components. HAGY's major products are *ferrite cores, transformers, fluorescent lights, soldering equipment,* and *phonograph record pressing equipment. Printed circuit board* production is presently limited but gaining in importance. There are 250 production workers.

HAGY plans a major expansion and modernization program to meet the growing needs of the computer industry. Market analysts predict HAGY will be a major purchaser of EIPT equipment during the next 2 or 3 years.

The Electronic Measuring Equipment Works (Elektromechanikai Gyara—EMG) was founded in 1950 and produces *signal generators, analog and digital voltmeters, digital frequency and time meters, oscilloscopes, AC stabilizers, electrocardiographs, polyphysiographs, electroencephalographs* and *other diagnostic equipment, multichannel medical oscilloscopes, doppler indicators, electronic logic modules, digital desk calculators, digital process control computers* and *multichannel analyzers.* The company began by producing telecommunications instruments, but soon branched out into industrial electronics and nuclear instruments. Production of highly regarded electrical medical instruments has been growing since the early 1960's and is earmarked for rapid expansion as exports to the West increase significantly. There has also been steady progress in the development of third-generation computers and peripherals. Most of EMG's output is exported, but the company also supplies the domestic end-product market.

The Orion Radio and Electrical Enterprise (Orion Radio es Villamossagi Vallalat), founded in 1913, is Hungary's oldest electronics firm. Orion's products include *microwave installations, television receivers, data transmission systems,* and *alphanumeric display systems.* Orion has concentrated its efforts for the past decade on producing for export high-quality *television sets, radio relay link equipment,* and *computer peripherals.* The Orion operation is highly integrated; the metal and plastic components produced by two of the enterprises are incorporated into the finished products assembled at the company's other three plants.

Exporting is one of Orion's primary activities. The first Orion television set was produced in 1956. Since then, Orion has produced 38 different models and has exported about 720,000 sets. In addition, 85% of the company's production of radio relay link equipment is exported.

Orion employs 4,300 production workers, 20% of whom are studying at universities and technical colleges on company scholarships. The company plans to expand its production and modernize its assembly lines in order to increase its exports.

The Electromechanical Enterprise (Elektromechanikai Vallalat—EMV), established in 1952, is the country's major producer of telecommunications end-products. In 1966, EMV was designated as Hungary's exclusive manufacturer of *radio broadcasting and television transmitting equipment.* EMV also produces *transportable carrier frequency telephone and telegraph equipment* and *measuring instruments.*

By 1975, EMV is scheduled to produce and install 17 transmitting stations ranging from 3KW VHF-FM transmitters to 20KW TV transmitters. In addition, EMV expects to put into operation a large short-wave station with two 250KW transmitters equipped with remote control directional antennae. EMV also produces for export and has its own foreign trade organization.

The Videoton Radio and Television Factory (Videoton Ipari es Kulkereskedelmi Rt.) has been exporting *television and radio receivers* to Eastern and Western Europe for some time. Its most popular product is the Minivizor television set, which incorporates German tuners and Italian chassis into the Hungarian end-product. West Germany, the largest purchaser of Minivizors, is estimated to have doubled its purchases in 1973.

With the incorporation of the Hungarian Optical Works into Videoton, the enterprise has shifted its emphasis to the production of *computers* and *peripherals.* Hungary is participating in the establishment of a uniform East European computer system, and Videoton has been chosen to produce the system's R10 computer and related peripherals. The company currently manufactures the 1010-B computer operating with silicon-based integrated circuits and a ferrite core memory. Other products include the Readman series of punched card readers and the TPA/i and TPA/70 small computers.

In cooperation with Siemens of West Germany, Videoton has been producing ferrite cores since 1970; a similar arrangement with UNIVAC of West Germany has initiated the production of printed circuits at Videoton. The enterprise has also concluded an agreement with Britain's International Computers, Ltd. (ICL), to assemble the ICL 4/50 and ICL 4/70 computer systems.

The Competitive Environment

Hungary manufactures some EIPT equipment.—Hungary's only commercial manufacturer of EIPT equipment is the Industrial Research Institute for Electronics, which operates under the jurisdiction of the Ministry of Metallurgy and Machine Industry. The Institute produces component processing and assembly equipment and component test equipment. It has recently developed an epitaxial diffusion technology, which it has applied to the development of RTL logic circuits and TTL circuits. MOS and analog circuits are also produced.

While introducing a new technology for the production of thin film circuits, the Institute developed a large variety of thin film integrated circuits and perfected the DTLZ industrial logic system. In the field of thick film technology, the Institute has developed a technique for producing carrier chips in different sizes and shapes from aluminum oxide (Al_2O_2).

Other ongoing projects at the Institute include the development of MSI and LSI production equipment and the perfection of simple devices for reliability testing and quality control.

Total domestic manufacture of EIPT equipment in Hungary reached $1.5 million in 1973 (see table 4). The Institute accounted for equipment valued at almost $1.1 million and the remainder represented manufacture for in-house use.

Domestic manufacture of EIPT equipment was estimated at 26% of the total Hungarian market in 1973; the other 74% was imported. U.S. suppliers already occupy a significant position in the Hungarian EIPT market; shipments from the United States were estimated at $3.25 million in 1973, representing an import market share of 76% and accounting for 56% of the overall EIPT market.

Demand for U.S.-made printed circuit production equipment and for passive component and miscellaneous production equipment is expected to be particularly brisk, with American manufacturers forecast to supply as much as 90% of Hungary's imports of this equipment in 1977.

Table 4.—Hungary: Consumption of electronics industry production and test equipment, by source and type of equipment, 1973

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	0.20	0.23	0.43
by other firms	.50	.57	1.07
Imported:			
from the U.S.	2.25	1.00	3.25
from other countries	.65	.40	1.05
Total	3.60	2.20	5.80

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study. Values based on Hungarian trade source estimates.

Government welcomes foreign investment.—Although Hungarian electronics firms are now seeking joint ventures and cooperative agreements with American firms in accordance with guidelines established in the Five Year Plan, only a few such agreements have yet been announced.

Imports of EIPT equipment from countries other than the United States were estimated at 18% of Hungary's total market in 1973. Imports from third countries were valued at $1.05 million, including $650,000 for production equipment and $400,000 for test equipment.

Although specific data are not available on countries of origin, West European and Japanese exporters of EIPT equipment are thought to have established strong footholds in Hungary. Some EIPT equipment also is reportedly imported from Hungary's principal trading partners—the Soviet Union, East Germany, and Czechoslovakia.

Trade regulations liberalized.—As in other Socialist countries, Hungary's international trade is closely regulated by the Government. Since the New Economic Mechanism reforms of 1968, however, 60 of Hungary's largest enterprises have been given the authority to trade directly with foreign companies. Foreign Trade Organizations (FTO's), which formerly were compulsory intermediaries in all international transactions, can now act as agents. Some enterprises, however, prefer to continue to rely entirely on FTO's to carry out all their foreign transactions. The most important FTO's dealing with EIPT equipment are Budavox, Electroimpex, Elektromodul, Videoton, and Metrimpex; all are located in Budapest.

All enterprises are required to obtain an import license from the Ministry of Trade. Manufacturers of high-priority items, such as electronics equipment, receive special consideration by the Ministry when seeking import licenses.

Customs duties are levied on the invoice price of equipment. Hungary has a three-tiered system of rates applicable to EIPT equipment. In the first category are imports from Hungary's East European economic partners, which are admitted at unspecified preferential rates.

Imports of EIPT equipment from countries in the second category, those which enjoy most-favored-nation treatment, are charged *ad valorem* duties ranging from 40 to 50%. EIPT equipment imported from the third category of countries which includes the United States, are charged *ad valorem* duties ranging from 80 to 100%. Additional information concerning import duties and regulations may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration (Room 4325), Washington, D.C. 20230.

The Hungarian Government is currently promoting the expansion of trade with the United States in accordance with the Fve Year Plan. Total trade between the United States and Hungary was valued at about $35 million in 1972 but is expected to increase substantially in the near future. Trade analysts predict sales of U.S.-made goods may reach $120 million annually within 2 years, while market research indicates a potential for sales of $77 million in EIPT equipment to Hungary during the period 1973-77.

U.S. suppliers not familiar with the Hungarian market can make business contacts through the Hungarian Chamber of Commerce and through participation in trade fairs and exhibits. Advertising is highly developed and is available to foreign companies. Hard currency is allocated for purchases of priority equipment. U.S. firms willing to accept a switch or barter agreement, or to accept partial payment in Hungarian products, will find it less difficult to complete sales of other equipment.

Technical Requirements

Hungary's electrical power supply is 110, 220, and 380 volt, 50 hertz. The metric system of weights and measures is used.

Further information on Hungary's technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

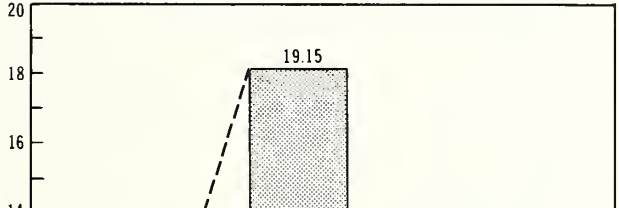
Electronics Industry Production & Test Equipment
Israel

Israel's electronics industry is expected to increase its spending for production and test equipment at an average annual rate of 13.5% between 1973 and 1977. Israeli purchases of electronics industry production and test (EIPT) equipment, estimated at $9.9 million in 1972 and at over $11 million in 1973, should total more than $19 million in 1977 (see table 1).

Expenditures for test equipment should grow at an average annual rate of 14.3% during the same 4-year period and should climb to more than $16 million in 1977, representing 85% of Israel's overall EIPT equipment expenditures in that year.

Israel: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Israeli trade source estimates.

Israel's 10-year (1972-81) plan for industrial development calls for production increases of 16% per year in the country's electronics industry. Government programs to expand Israel's exports of electronics equipment, to stimulate the development of new electronics products for both the defense and civilian sectors, and to ensure a rapid increase in the use of advanced technology throughout the country should result in substantial increases in the industry's requirements for EIPT equipment through the remainder of the decade.

The United States satisfied 70% of Israel's requirements for production equipment and 75% for test equipment in 1972. U.S. EIPT equipment sales to Israel in that year exceeded $7.3 million, or 74% of Israel's total consumption. The $1.6 million in imports from other countries, including equipment produced by overseas subsidiaries of U.S. firms, represented 16% of the 1972 EIPT equipment market. Domestically produced EIPT equipment was valued at $500,000 in 1972 and represented only a 5% market share. Production and test equipment made by domestic manufacturers for their own use accounted for another 5% of total consumption.

Since many of Israel's leading electronics companies are affiliated with U.S. firms, close ties have been established between the U.S. and Israeli electronics industries. These ties, strengthened by the large percentage of Israeli electronics engineers who have studied or worked in the United States, have

Israel—Selected Indicators
(1972)

Gross national product:	**$6.9 billion**
Population:	**3.15 million**
Total country imports:	**$1.9 billion**
Total country exports:	**$1.1 billion**
Exchange rate (October, 1973):	**4.2 Israeli pounds = US$1**

contributed to the strong acceptability of U.S.-made products in Israel during the past 25 years.

The demonstrated preference of Israeli end-users for U.S.-origin equipment should be reflected in increased sales for American suppliers during the next several years. Trade sources anticipate that U.S. EIPT equipment sales in Israel will total about $13 million in 1977.

Selected Sales Opportunities

A market research study recently conducted in Israel for the U.S. Department of Commerce reveals highly favorable sales prospects for U.S. EIPT equipment manufacturers during the next several years. Israeli demand is expected to be strongest for the following equipment:

Semiconductor and Integrated Circuit Production Equipment
- Crystal growing equipment
- Dicing machines
- Conveyor dryers
- High-vacuum feed-throughs
- Ion implantation equipment
- Plotters
- Vacuum pumps
- Diamond and laser scribing machines
- Soldering equipment
- Leak detectors

Printed Circuit Production Equipment
- Cleaning and drying equipment
- Numerically controlled drilling machines
- Silk screen equipment
- Fusing and leveling machines

Wiring Assembly and Other Interfacing Equipment
- Wire-wrap systems
- Automatic welding systems
- Wire strippers

Passive Component and Miscellaneous Production Equipment
- Metal forming machines
- Labeling machines
- Embossing machines
- Metal finishing equipment
- Coil winders

Test Equipment for Production/Inspection of Electronic Products
- Integrated circuit test equipment
- Transistor test equipment
- Diode test and classifier equipment
- Resistor test equipment
- Relay test equipment
- Wiring test equipment
- Printed circuit board testers
- Environmental test chambers
- Chip evaluation equipment
- Digital systems analyzers
- Wire bond testers
    —signal generators
    —spectrum analyzers
    —power meters
    network analyzers
- Oscilloscopes
- Digital volt multimeters

Production equipment.—Israeli expendtures for production equipment, which increased from $1.4 million in 1971 to an estimated $1.9 million in 1973, should grow at an average annual rate of 9.4% during the 1973-77 period. Israel's 1977 production equipment market should approach $2.8 million, with sales of semiconductor and integrated circuit production equipment expected to account for over 70% of this market.

Israel's electronics industry considers U.S.-made production equipment to be unmatched in design and performance. In addition, this technologically sophisticated industry has found that U.S. manufacturers are its best source for the advanced instruments and machinery needed in its production operations. These factors give American suppliers a strong competitive edge in Israel and should ensure excellent sales of production equipment during the next several years.

Israeli manufacturers of semiconductors and integrated circuits, currently operating their production equipment at near capacity, constitute an excel-

Table 1.—Israel: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	1.05	1.14	1.50
Printed circuit production equipment	.22	.21	.23
Wiring assembly and other interfacing equipment	.06	.08	.08
Passive component and miscellaneous production equipment	.08	.09	.11
Test equipment for production/ inspection of electronics products	6.11	8.38	9.63
Total	7.52	9.90	11.55

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study .Values based on Israeli trade source estimates.

lent potential market for U.S. manufacturers. Faced with the need to expand production to meet the country's increasing demand for components and the continuing requirements of the military sector for custom-built integrated circuits, these manufacturers plan heavy investments in additional equipment.

Israel's market for semiconductor and integrated equipment is expected to increase at an average annual rate of 7.6% during the 1973-77 period. The market for this product subcategory was valued at $1 million in 1971 and an estimated $1.5 million in 1973; it is projected to exceed $2 million in 1977.

To manufacture printed circuit boards (PCB's) that can be successfully marketed as exports and at the same time to meet a rising demand for their products, Israel's electronics manufacturers will have to replace a significant portion of their current (and in many cases near-obsolete) PCB production equipment during the next few years.

These replacement requirements should create favorable sales opportunities for U.S. suppliers of advanced equipment. Israeli expenditures for PC production equipment, which rose from $219,000 in 1971 to $230,000 in 1973, are expected to grow at an average annual rate of 6% through the 1973-77 period, climbing to $290,000 in 1977.

The use of automated wiring systems by Israel's telephone exchange manufacturers should contribute substantially to anticipated increases in Israeli purchases of wiring assembly and other interfacing equipment. The market for this product subcategory was estimated at $60,000 in 1971 and $80,000 in 1973; it is expected to exceed $115,000 in 1977, representing an average annual growth of 9.5%.

Israel's market for passive component and miscellaneous production equipment has grown rapidly in recent years, with sales climbing from $85,000 in 1971 to $110,000 in 1973. This market should triple during the next 4 years, reaching a total of about $330,000 in 1977.

Test equipment.—The thorough testing needed to manufacture electronic products that meet the rigid specifications of Israel's military sector has resulted in strong, steady growth of the country's test equipment market during recent years. Israeli requirements for test equipment increased 58% between 1971 and 1973, with the market rising from $6.1 million to an estimated $9.6 million. An increase of 70% is forecast for the 1973-77 period, with expenditures expected to total more than $16 million in 1977.

American suppliers enjoy a predominant lead in the sales of test equipment to Israel because only U.S.-made equipment is considered to be sufficiently exacting to ensure the quality of defense products. Trade sources feel that this lead will meet with little challenge during the next few years.

Israel's Electronics Industry—Basic Data
(1972)

Total value of production:	**$157 million**
Number of manufacturers:	**65**
Industry labor force (1971):	**11,400**
Output of television receivers (1971):	**62,000**

Israel's increasingly sophisticated electronics industry is also looking to the United States as a source for advanced systems for component and module testing, printed circuit testing, and telephone equipment testing. Although the market for such systems was estimated at only $200,000 in 1972, industry analysts anticipate that this market could grow substantially in the near future.

The Electronics Industry

Electronics is one of Israel's fastest growing industries. Armed forces demand for the most advanced electronic equipment, coupled with government support and financing of the industry, has generated dramatic increases in electronics industry production. This growth is expected to continue as companies increase their production for nonmilitary end-users and place greater emphasis on expansion of export sales.

Industry highly concentrated.—The electronics industry comprises approximately 65 companies. The 11 largest companies, each with annual sales of over $1 million, account for 93% of annual production; of these, the top 5 companies have annual sales of over $8 million and account for over 80% of total production (see table 2). Most of the remaining companies are small laboratories, workshops, and plants employing an average of fewer than 10 workers.

Total employment in the electronics industry reached 11,400 in 1971, with over 8,300 workers concentrated in the country's 5 largest firms. The government's universities and technical colleges provide a continuing supply of qualied professionals adequate to meet the industry's needs.

Production of electronic equipment in Israel was valued at $157 million in 1972 and is expected to approach $330 million in 1977. Anticipated sales of television sets and telephone exchanges reflect the growth trend. The industry in 1971 produced 62,000 television sets valued at $14.3 million. This number may increase to as high as 100,000 sets per year in the near future.

Also a large unfulfilled demand exists for telephone exchanges. There were 60,000 outstanding applications for telephones at the end of fiscal year

Table 2.—Israel: Leading electronics manufacturers, 1972 [1]

Company	Sales ($ millions)	Percent of total output	No. of employees	Products
Tadiran, Israel Electronics Industries, Ltd.	63.1	39	3,500	Radio and television receivers, air conditioners, military communications equipment, components, and telephone equipment
Telrad Telecommunications and Electronic Industries, Ltd.	23.8	15	1,000	Telecommunications equipment
Israel Aircraft Industries, Ltd. Plant "B"	16.7 (1971)	10	1,300	Computers, radar, and control systems; servos; printed circuits; flight control and electronic systems
Elta Electronics Industries, Ltd.	14.5	9	1,450	Communications, navigation, microwave, and radar equipment and systems; medical equipment; printed circuits
Motorola Israel Ltd.	13.1	8	1,060	Communications systems, FSK and time-division miliplex euipment, teleprinted terminals, alarm services
American Electronic Laboratories Israel, Ltd.	5.2	3	360	Military systems, communications equipment
Israel Electro-Optical Industry, Ltd.	4.0 (1971)	3	250	Optical, electro-optical, and electromechanical devices
Elbit Computers Ltd.	3.1 (1971)	2	380	Minicomputers, data preparation systems
Elscint, Ltd.	2.6	2	330	Nuclear instruments
Scientific Data Systems, Israel, Ltd.	1.9 (1971)	1	90	Computer memory systems
Monsel Electronic	1.4 (1970)	1	45	Digital instruments

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[1] Actual or estimated turnover for FY 1972 unless otherwise noted.

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

(FY) 1971, and this figure rose to 84,000 by the end of FY 1972. In spite of increased investment in telephones, the waiting list may approach 100,000 before installations begin to keep pace with demand.

Investments in telephone equipment totaled $18 million in FY 1971 and $34 million in FY 1972 and are estimated to reach $60 million in FY 1973. Approximately 40% of the telephone equipment purchased in Israel is produced locally.

Five of the largest manufacturers of electronic equipment in Israel are overseas subsidiaries of U.S. firms. General Telephone and Electronics owns 50% of the country's largest electronics producer, Tadiran Israel Electronics Industries, Ltd.; and Motorola, Inc., has a majority share of Motorola Israel, Ltd., the country's fifth largest company. Other overseas U.S. subsidiaries among Israel's largest electronics companies include: American Electronic Laboratories Israel, Ltd.; Elbit Computers, Ltd., a subsidiary of The Control Data Corporation; and Monsel Electronic Instruments, Ltd., a subsidiary of Monsanto Electronics.

The Dutch company, N.V. Optische Industrie "De Oude Delft,' with its 50% ownership in Israel Electro-Optical Industry, Ltd., is the only foreign non-U.S. firm with an interest in one of the top 11 Israeli electronics companies.

Although electronics equipment production ranges from printed circuits to complete systems, Israeli electronics firms are not integrated from component production through end-product distribution. The country's larger producers generally are composed of several specialized plants. Motorola, for example, has a printed circuits plant, a communications plant, a mechanical equipment plant, and a military hardware production plant. This partially integrated company continues to rely on imports to fill its requirements for basic components.

One of the goals of Israel's 10-year plan (1972-71) for industrial development is the establishment of more integrated production in the electronics industry and the replacement of imported components by those produced locally. This plan was promulgated by the Government Center for Industrial Planning in November 1972. Its policies are to encourage the growth of exports and increase production through the use of advanced technology and highly skilled manpower. Continued emphasis will be placed on the development of companies supplying electronics equipment to Israel's defense forces.

Much of the development of Israel's electronics industry has resulted from the research and development associated with the production of sophisticated modern military equipment. Although the government will continue to give high priority to military electronics equipment production, efforts are being made to increase production oriented to civilian needs.

Under Israel's Law for the Encouragement of Capital Investments, projects that increase exports, reduce reliance on imports, absorb immigrants, or populate sparsely settled areas are entitled to cash grants for building and site development and for the purchase of equipment. Grants made to the electronics industry under this law during the period 1969-72 approached $3 million.

Other government programs that benefit the electronics industry include tax concessions, medium- and long-term loans at reduced interest rates, and grants for postgraduate training of employees.

Industry outlook favorable.—Fueled by increasing Israeli Government support, the electronics industry is expected to continue its rapid growth over the next few years. Total production should rise at about a 16% annual rate from the 1972 level of $157 million to nearly $330 million in 1977. Current government projections indicate that 60% of incremental output will be for domestic consumption and 40% for exports. About 60% of the increased domestic production will be consumed by civilian end-users and 40% by the armed forces.

The rapid development of the electronics industry has created a deficit in the supply of highly skilled production workers. The growth of salaries in the past few years has narrowed the gap between the high cost of automated machinery and labor costs. As a result, electronics companies are expected to invest increasing amounts in automated equipment for production and testing.

The structure of the electronics industry in Israel is not expected to change substantially during the next several years. Rising demand will enable smaller companies to continue producing profitably. No mergers are expected among the country's largest electronics firms since they are all partially or wholly owned by U.S. firms or other Israeli companies. Opportunities for new suppliers of products currently in use are limited, but the demand for sophisticated equipment is expanding rapidly and offers numerous opportunities for new market entrants.

Electronics Manufacturers' Profiles

There are no large manufacturers of passive components in Israel and the country's only producer of integrated circuits and semiconductors is a subsidiary of a U.S. firm. The following profiles highlight three companies that are typical of Israel's small- to medium-size component manufacturers.

The largest circuit board manufacturer in Israel has invested $600,000 in EIPT equipment, of which 90% is of U.S. manufacture. The company, which was founded in 1970, produces the following types of *printed circuit boards: single- and double-sided, plated through hole, multilayer,* and *flexible cable.* Production in 1972 was valued at approximately $1 million, which represented a total volume of about 60,000 printed circuit boards. About 40 of the firm's 55 employees are production workers.

No automated methods are used in production, and there is no computerized equipment. Numerically controlled drilling machines are utilized. Current plans include replacing most production equipment every 4 years to keep up with changes in technology.

Another producer of *printed circuit boards* uses equipment primarily of European origin. This firm, which has 20 employees, emphasizes the production of *single-sided printed circuit boards,* sales of which totaled $250,000 in 1972.

Plans include expansion of the production facilities with an investment of $120,000. Although this company does not currently use automated production methods, the acquisition of numerically controlled equipment and future investment in automatic production and test equipment are under consideration. In an attempt to diversify its market, the company started exporting in 1973.

A small company with 12 employees is representative of the many small plants producing electronics equipment and components in Israel. Concentrating on *microwave* and *r-f components,* the company's total output was valued at $80,000 in 1972.

The total investment in production equipment is about $100,000 and 60% of the equipment is of U.S. manufacture. The balance of the equipment has been built in-house or purchased from Israeli manufacturers. Although the firm plans to double its investment in equipment during the 1972-77 period, there are no plans to automate production.

The following profiles outline the activities of two of Israel's largest electronics equipment manufacturers:

One of Israel's leading electronics firms produces both components and end products. The firm's production in FY 1972 approached $15 million. Manufacture of components includes *printed circuits, microwave components, microelectric hybrid thick and thin films, linear integrated circuits,* and *stripline circuits.* Production of end-products includes *communication systems, navigation systems, coronary care equipment, pacemakers,* and *HF, VF, and UHF military communications equipment.* Both the military and civilian sectors are purchasers of the products of this firm. Of 1,500 total employees, 800 are production workers.

The total investment in EIPT equipment is about $3.7 million. About 80% of this equipment was supplied by U.S. manufacturers.

A major Israeli manufacturer of *television and radio receivers* produced $4 million worth of equipment in 1972, primarily television receivers. This firm builds about one-fourth of Israel's locally produced television sets.

The company's total investment in electronics production and test equipment amounts to $1.2 million, of which 90% is of German origin. Although there are no specific plans for investment, much of the company's production and test equipment will have to be replaced in the next few years.

Competitive Environment

Domestic sales of locally produced EIPT equipment totaled $1 million in 1972 and represented only 10% of the total Israeli market (see table 3). The value of production equipment amounted to approximately $160,000, half of which was produced for in-house use. Sales of test equipment reached an estimated $840,000 in 1972 and were divided equally between production for in-house use and sales to other domestic end-users.

The majority of the firms manufacturing EIPT equipment in Israel are subsidiaries of U.S. companies. Kulso, Ltd., a subsidiary of Kulicke and Soffa Industries, Inc., of Fort Washington, Pennsylvania, is one of Israel's largest EIPT equipment manufacturers.

Table 3.—Israel: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-users	.08	.42	.50
by other firms	.08	.42	.50
Imported:			
from the U.S.	1.06	6.28	7.34
from other countries	.30	1.26	1.56
Total	1.52	8.38	9.90

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study .Values based on Israeli trad source estimates.

With a staff of 300, the company has been producing equipment used in the manufacture of semiconductors and integrated circuits since 1969. Its major products include thermocompression and ultrasonic bonders, XYZ micropositioners, probing systems, carbide capillaries, carbide wedges, die-collets, miniature electrodischarge machines, and many precision slides and components. Almost all of Kulso's production is exported.

Monsel Electronic Instruments, Ltd., is a smaller firm controlled by Monsanto Electronics, Inc. Over 80% of its production is exported. Monsel manufactures the "mini-line" of digital instruments for laboratory and industrial control operations, including counter timers, digital voltmeters, pulse generators, and signal generators.

Tabor Electronics, Ltd., another small EIPT equipment manufacturer, is a newcomer to the Israeli market. The company has been producing electronic laboratory instruments, digital counter/timers, industrial counters, digital voltmeters, and analog instruments since 1971. Tabor estimates that 80% of its output will be exported. Most other manufacturers are very small workshops producing only a limited amount of EIPT equipment.

Israel is highly dependent on imports to fill its needs for EIPT equipment. It imported 90% of its needs for EIPT equipment in 1972 and U.S. manufacturers supplied 80% of this total. Israeli imports of production equipment from the United States in 1972 amounted to $1.06 million, representing 70% of the market (see table 4). Imports of test equipment from the United States in the same year reached $6.28 million, or 75% of total Israeli requirements. The United States is expected to maintain its dominant position in the Israeli market, with sales of production equipment projected in 1977 to approach $2 million, or 65% of the total market for these products. U.S. shipments of testing equipment in the same year should exceed $11 million, representing about 68% of the market.

The United States continues to dominate the Israeli EIPT market in spite of increasing competition from German and Japanese suppliers. Many of Israel's largest electronics firms have financial resources in the United States and regularly purchase equipment of U.S. manufacture. Other firms prefer to pay for their equipment in U.S. dollars and thus insist upon equipment from U.S. factories, even when the same equipment may be offered by a European subsidiary of the same U.S. company.

The general tendency toward price-consciousness among Israeli EIPT equipment purchasers is an-

Table 4.—Israel: Imports from the United States of electronics industry production and test equipment, 1972 and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	1.06	1.43	1.79
Test equipment	6.28	8.86	11.08
Total	7.34	10.29	12.87

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study. Values based on Israeli trade source estimates.

other factor that currently favors U.S. suppliers. Recent dollar devaluations have made U.S. equipment competitive with similar equipment offered by European and Japanese suppliers. In cases of equivalent cost, Israeli purchasers tend to choose American-made equipment because it is familiar to them and they have greater confidence in it.

German and Japanese EIPT manufacturers have recently increased their efforts in the Israeli market. Major German EIPT manufacturers doing business in Israel include W. L. Gore, G.m.b.H., Koerting Kiefel, G.m.b.H., and Ernst Sachs (ERSA), K.G. Among important Japanese suppliers to the Israeli market are Iwatsu Electronics, Nikon—Instruments Division, and The Kyowa Electric Instrument Company. The several British firms that export to Israel include: C. & E. Bradley Electronics, Ltd.; Lyons Instruments; Multicore, Ltd.; and Marconi Instruments. Companies in Australia, Denmark, the Netherlands, Italy, Sweden, and Switzerland also supply EIPT euipment to Israel.

Israel's customs duties are levied on the c.i.f. value of imported equipment. Most EIPT equipment is either exempt from duty or falls in the 10 to 20% dutiable rate category. The government has recently imposed a special additional duty of 20% on all imported goods.

Many electronics companies qualify as approved enterprises under Israel's Law for the Enforcement of Capital Investment and are exempt from customs duties on imported machinery and equipment. These companies may import equipment after giving sufficient proof to the Ministry of Commerce and Industry that the goods are not produced in Israel or that similar goods produced in Israel are not competitive. However, the 20% additional duty is not waived and must be paid on all equipment imported by approved enterprises.

Additional information on import duties and regulations may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Room 5201 Main Commerce Building, Washington, D.C. 20230.

Although U.S.-made EIPT equipment has an excellent reputation in Israel for technical quality and performance, U.S. suppliers could increase their sales to Israel through the improvement of quality control and shipping practices. Most EIPT equipment exported to Israel from the United States is shipped via air freight, and, although most of it is packaged adequately and arrives in good condition, some equipment has been damaged in transit. The use of special packaging techniques should alleviate this problem.

Technical Requirements

The Israel Electric Corporation provides alternating current throughout the country on a frequency of 50 hertz. The standard tension for single-phase, 2-wire supply is 230 volts; for 3-phase, 4-wire supply, it is 400 volts between phases and 230 volts between each phase and neutral. The metric system of weights and measures is used for all electronic equipment calibration. Further information on Israeli technical standards can be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

The following market research is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M Main Commerce Building, Washington, D.C. 20230: "The Market for Electronics Industry Production and Test (EIPT) Equipment in Israel," DIB 74-01-501, May 1973.

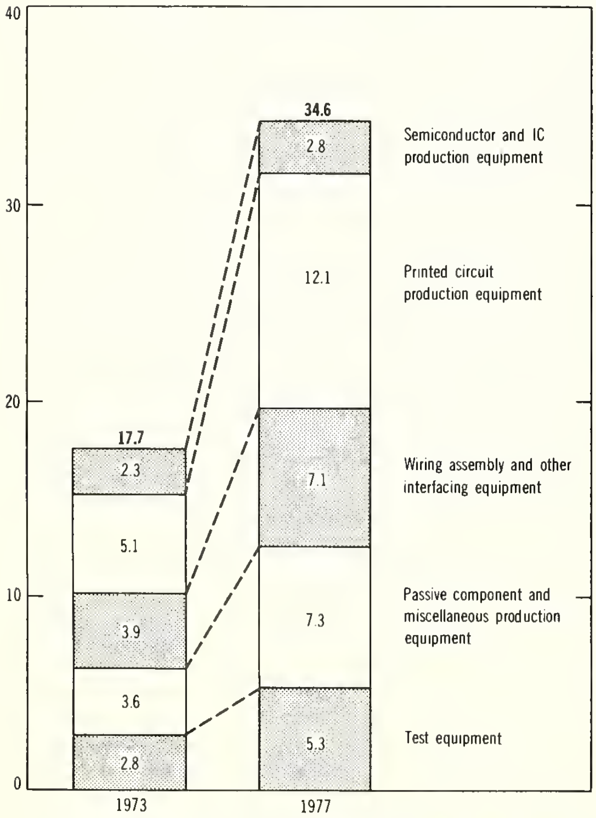
Electronics Industry Production & Test Equipment

Italy

The increased mechanization of manufacturing processes, viewed by Italy's electronics industry as a step necessary for its survival, should result in average annual increases of over 18% in expenditures for production and test equipment during the 1973-77 period. The market for electronics industry production and test (EIPT) equipment, estimated at $15.6 million in 1972 and $17.7 million in 1973 (see table 1), is expected to total over $34 million in 1977.

Italy: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Italian trade source estimates.

Italy's electronics industry benefited for many years from low production costs that enabled it to market its electronic goods at very competitive prices. Recent rises in production costs, however, stemming from wage increases as high at 20% per year since 1969, have weakened the industry's position in the international market.

In an effort to check further cost increases and reestablish their competitive position, electronics manufacturers that traditionally relied on manual and semi-automatic production and test equipment have begun investing heavily in advanced machinery and equipment. The industry's growing appreciation of the cost reductions that can be realized from greater automation in manufacturing should result in a significant expansion of its EIPT equipment requirements throughout the remainder of the 1970's.

The acknowledged technological superiority of U.S.-made equipment has already given American manufacturers a clear competitive edge in Italy's EIPT equipment market. U.S. sales to Italy in 1972 amounted to $6.1 million, or over 39% of the market. Imports from other countries, valued at $2.9 million in 1972, reflected a market share of 18.6%. Domestic manufacture constituted the remainder of the market, making up over 40%, or $6.6 million, of total consumption.

Nearly three-quarters of total domestic production, or $4.7 million, represented EIPT equipment manufactured for sale; equipment manufactured for inhouse use constituted the remainder.

More than 90% of the EIPT equipment manufactured in Italy today is of less sophisticated design, and domestic manufacturers have indicated no plans for changing the orientation of their production.

Italy—Selected Indicators (1972)

Gross national product:	**$118.6 billion**
Population:	**54.5 million**
Total country imports:	**$19.4 billion**
Total country exports:	**$18.6 billion**
Exchange rate (October 1973):	**564 lira = US$1**

Thus, Italy's electronics industry, now in need of more automated equipment, can be expected to rely increasingly on foreign suppliers, particularly on those from the United States. Industry sources anticipate that American manufacturers will advance the value of their EIPT equipment sales in Italy to over $19 million in 1977, realizing a 55% share of the market in that year.

Selected Sales Opportunities

Italian expenditures for electronics industry production and test equipment during the 1974-77 period are expected to approach $100 million. A market research study recently conducted in Italy for the Office of International Marketing, U.S. Department of Commerce, indicates that American manufacturers should be able to capitalize on the growing Italian requirements for sophisticated equipment and, at the same time, realize continued strong sales from Italy's needs for conventional equipment.

Semiconductor and integrated circuit production equipment.—Italy's market for semiconductor and integrated circuit production equipment rose from $2 million in 1971 to an estimated $2.3 million in 1973. Growing at an average annual rate of 5% between 1973 and 1977, the market for this equipment is expected to advance to $2.8 million in the latter year. Products having the best sales potential for U.S. suppliers include:

- Masking and step-and-repeat cameras
- Coordinate measuring machines
- Crystal growing equipment
- Dicing machines
- Epitaxial growth equipment
- Chemical milling etchers
- Flat pack sealers
- Conveyor, diffusion, and firing furnaces
- High-vacuum feed-throughs
- Screen printers
- Diamond and laser scribing machines
- Thermocompression and ultrasonic bonders
- Soldering equipment
- RF and diode sputtering equipment
- Wafer sorters
- Leak detectors

Manufacturers of semiconductors and integrated circuits, aware of the need for continuously updating their production methods and upgrading their equipment, look to the United States for the most advanced technological products available. Approximately 90% of the coordinate measuring machines now in use in Italy are U.S.-made, as also are more than 75% of all screen printers.

Thermocompression and ultrasonic welders, leak detectors, masking and step-and-repeat cameras, and conveyor, diffusion, and firing furnaces of American manufacture are also widely used in Italy. Because Italian end-users appreciate the design characteristics and performance capabilities of U.S.-made equipment, competitively priced American products should continue to be in demand in Italy.

Although the concept of laser engineering and electronic applications of lasers have only recently been introduced in Italy, the market is receptive to additional equipment of this type. Assertive marketing by U.S. suppliers of diamond and laser scribing machines should result in the strong expansion of this segment of Italy's EIPT equipment market.

Printed circuit production equipment.—Italian expenditures for printed circuit production equipment are expected to grow 24% annually during the next 4 years, totaling over $12 million in 1977. Purchases were valued at $3.4 million in 1971 and estimated at $5.1 million in 1973. Included among the future requirements of Italy's electronics industry that might be satisfied by U.S. manufacturers of printed circuit production equipment are:

- Cleaning and drying equipment
- Photoprinters
- Drilling machines
- Photoresist systems
- Component inserting and sequencing machines
- Routers and profilers
- Protective coating equipment

Table 1.—Italy: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	2.0	2.2	2.3
Printed circuit production equipment	3.4	4.3	5.1
Wiring assembly and other interfacing equipment	2.7	3.4	3.9
Passive component and miscellaneous production equipment	2.7	3.1	3.6
Test equipment for production/inspection of electronics products	2.3	2.6	2.8
Total	13.1	15.6	17.7

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Italian trade source estimates.

- Multiple slotting machines
- Prepping machines

Greater in-house production of printed circuits among Italy's electronics manufacturers is generating additional requirements for printed circuit production equipment, and this demand is expected to rise sharply over the next several years. Italian manufacturers are looking for equipment that incorporates advanced features and is designed for efficient production.

U.S. firms already have captured most of the Italian market for high-performance drilling machines, insertion and sequencing apparatus, automated multiple slotting machines, and prepping equipment. With virtually no competition for sales of these products, American companies should continue to make a strong showing through 1977.

Wiring assembly and other interfacing equipment.—Purchases of wiring assembly and other interfacing equipment totaled $2.7 million in 1971 and were estimated at $3.9 million in 1973. Italian requirements are expected to increase by an average of 16.5% annually during the 1974-77 period, resulting in a projected sales volume of over $7 million in the latter year. U.S. suppliers should find a receptive market in Italy for almost all products in this subcategory, especially:

- Point-to-point wiring equipment, wire-wrap systems, automatic-reflow soldering systems, automatic welding systems
- Color-coding machines
- Crimping machines
- Cutters
- Terminal-installing machines
- Cable harness equipment
- Connector assembly machines
- Card assembly machines

Microminiaturization of electronic equipment and the need to minimize manual wiring and interfacing operations in an effort to reduce costs are forcing Italy's electronics manufacturers to find new and more sophisticated solutions to their wiring problems.

Italian requirements for advanced wiring assembly and related equipment are expanding rapidly, and industry sources indicate that the market for such equipment is far from saturated. Small and medium-size firms, anxious to replace conventional equipment with advanced machinery, are excellent potential customers.

The edge held by U.S. suppliers in this product subcategory should ensure continued sales in the foreseeable future. In 1972, the United States met 80% of Italy's demand for point-to-point wiring equipment and 85% of the demand for the cutters used in process automation. American-made stripper-cutters have also sold well and, until the recent introduction of a domestically produced card assembly machine, the United States controlled sales of this product.

Italy's Electronics Industry—Basic Data (1972)

Total value of production:	**$1.2 billion**
Number of manufacturing firms (1971):	**1,300**
Industry labor force:	**25,000**
Output of selected products:	
Semiconductors:	**$67.5 million**
Computers and other electronic office machines:	**$115.6 million**
Radio-television (consumer):	**$250 million**
Telephone and professional radio:	**$822.8 million**
Total capital investments (est. 1972):	**$261.8 million**

Passive component and miscellaneous production equipment.—The Italian electronics industry spent $2.7 million in 1971 and an estimated $3.6 million in 1973 for passive component and miscellaneous production equipment. This market should increase at an average annual rate of 19% between 1973 and 1977, climbing to over $7 million by 1977. Those products having high sales potential for U.S. manufacturers are:

- Custom and special assembly machines
- Molding presses
- Riveting machines
- Micromaterials handling and positioning equipment
- Labeling machines
- Embossing machines
- Advanced metal finishing equipment
- Coil winders
- Capacitor manufacturing machines

The manufacture of passive components in Italy is concentrated in small and medium-size firms, which only recently adopted the automation and mechanization processes initiated earlier by active component manufacturers. This practice should become more widespread as passive component manufacturers, spurred by a 14.5% production increase between 1972 and 1973, expand their current equipment installations. It is expected that the greatest needs of these firms will be for medium-capacity equipment.

The large number of U.S. subsidiaries manufacturing passive components in Italy has given the United States a substantial share of the market for micromaterials handling and positioning equipment in spite of stiff competition from Switzerland. U.S.-made automatic and high-performance riveting machines are expected to be used increasingly in this industrial sector, as are automated capacitor manufacturing machines.

The United States now controls sales of labeling machines and, despite strong domestic and foreign competition in the marketing of coil winders, leads in sales of special (e.g., toroidal) coil winding equipment.

Test equipment for production/inspection of electronic products.—Italy's requirements for test equipment are expected to grow an average of over 17% per year between 1973 and 1977, raising the market to more than $5 million in 1977. Purchases of test equipment in 1971 were valued at $2.4 million; in 1973, they were estimated at almost $3 million. Good sales potential is offered by:

- Integrated circuit test equipment
- Transistor test equipment
- Diode test and classifier equipment
- Resistor test equipment
- Relay test equipment
- Printed circuit board testers
- Chip evaluation equipment
- Digital systems analyzers
- Thick/thin film resistor trimmers
- Wafer probing equipment
- Wire bond testers

The introduction of more sophisticated production methods in Italy's electronics industry is stimulating the increased use of testing equipment. Because a relatively large share of Italy's potential market for conventional test equipment is already being satisfied by equipment manufactured in-house, purchases over the next several years should be concentrated on new or advanced test devices.

Linear test systems offer excellent sales potential for U.S. manufacturers, whose integrated circuit test equipment has already found wide acceptance in Italy. Sparking the demand for resistor test equipment is the increasing need of Italian firms for "incoming inspection" of purchased components; automatic and semiautomatic equipment of U.S. manufacture, considered to be superior in performance, is being used extensively in Italy for this purpose.

The demand for wire bond testers depends to a large extent on the suitability of the product to the specific needs of the end-user, as does demand for printed circuit board testers, many of which are now being manufactured in-house. Nevertheless, the world leadership of the United States in the production of both types of equipment should ensure continued sales through 1977.

Although thick/thin film resistor trimmers, especially those based on lasers, have only recently come into use in Italy, demand is growing rapidly. This type of equipment currently is being marketed in Italy only by U.S. firms.

The Electronics Industry

During a 25-year period of development and expansion, Italy's electronics industry was known as the "European Japan" because of its capacity to produce conventional electronic components and equipment at competitive prices for export to Europe and throughout the world.

Since 1969, however, this favorable economic position has been damaged by social conflict, strikes, and labor cost increases that resulted in substantial rises in production costs. Forced to quote higher prices on the international market, Italian electronics manufacturers suffered losses in sales that led many to abandon product lines requiring a high degree of manual operation for their manufacture.

In an effort to regain its competitive position, the electronics industry is undergoing rapid technological changes, both in terms of end products and systems used in manufacturing and assembly processes. The realization that advanced production and test equipment can result in substantial decreases in running and operating costs is spurring industry-wide modernization and purchasing programs that ensure a steady demand for sophisticated EIPT equipment in Italy well through 1977.

Holding groups important to industry.—Italy's electronics industry comprises approximately 1,300 manufacturing firms, with a total labor force of about 25,000. Most of the firms are of medium size, employing fewer than 250 persons. According to recent statistical data, only 31 electronics and electromechanical companies had a business volume of $17 million or more in 1971.

Italy's few large electronics manufacturers are closely controlled by holding organizations that include Montedison, Fiat, Olivetti, and the Government electronics group STET (part of the Istituto Ricostruezione Italiana—IRI). STET, through its subsidiary, Societa Italiana Telecomunicazioni Siemens SpA (SIT Siemens), has interests in the component manufacturers ATES Componenti Elettronici SpA, Industria Elettronica Telecomunicazioni SpA (ELTEL), and Siemens Data.

Other STET subsidiaries/affiliates and their primary areas of activity include SIRTI (installation of telecommunications systems), CSELT (research), Selenia SpA (radar, radio communications, and missiles), and ELSAG (machine automation and industrial processes).

The Montedison group includes SISTEL (missile installations), IME (electronics machinery), Montedel Ime-Montedison Elettronica (electronic instruments and process computers), and Officine Galileo SpA (scientific instruments and lasers). Among the companies affiliated with Fiat are Societa Generale Semiconduttori SpA (SGS) (active components), Telettra SpA (electronic controls and automotive electronics), and Magneti Marelli SpA (radio and TV receivers). Fiat also has a 20% interest in the component manufacturer ATES.

Although Olivetti's general policy is to concentrate all basic electronics activities within its corporate structure, this company also controls La Zinco-Celere, a firm specializing in microcircuits processing.

U.S. participation extensive.—Sales by subsidiaries of U.S. firms account for about 25% of the business volume of the 30 leading companies in Italy's electronics, electromechanical, and electric industries. Although U.S. participation extends to all major electronics branches, there is a concentration in the areas of computers, business machines, telecommunications, components, and professional electronics.

The major American companies operating factories in Italy and their Italian manufacturing subsidiaries are listed in table 2.

Olivetti, Italy's leading manufacturer of computers, accounts for a significant portion of the national production of data processing equipment in spite of stiff competition from IBM Italia, Univac Sperry Rand, and Compagnia Generale di Elettricita. Among the country's leading producers of radio and television receivers are Magneti Marelli, Voxson F.A.R.E.T. SpA, Autovox, Philco, and Selaco, the latter controlled by Zanussi Industrie. SIT Siemens, Italy's major telecommunications equipment manufacturer, finds its keenest competition from the U.S.-controlled GTE Telecommunicazioni and ITT-Face Standard.

Over 30% of the active components manufactured in Italy are produced by ATES and SGS, with the American-controlled Texas Instruments Italia and ITT-Face Standard together producing an additional 55%. Ducati Elettronica Microfarad SpA is Italy's leading producer of passive components, with a market share of over 15%. Among other important passive component manufacturers are ATES, Mial SpA, ELTEL, and FIVRE (Fabbrica Italiana Valvole Radio Elettriche SpA).

Table 2.—U.S. manufacturing subsidiaries in Italy

U.S. parent firm	U.S. subsidiary
General Electric Co.	Compagnia General di Elettricita SpA
General Instrument Corp.	General Instruments Europe SpA
GTE Sylvania International	GTE Telecomunicazioni SpA
IBM Corp.	IBM Italia SpA
ITT Corp.	ITT-Face Standard SpA
Litton Industries	Veam SpA
Spectrol	SP Elettronica SpA
Sperry Rand Corp.	Univac Sperry Rand
Sprague Electric Co.	Sprague Creas SpA
3M Co.	3M Italia
Texas Instruments, Inc.	Texas Instruments Semicondut-tori Italia SpA

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

Increase in vertical integration expected.—The government-controlled sector of the electronics industry, under the guidance of STET, has a highly integrated structure enabling the establishment of mutual customer-supplier relationships between the STET units manufacturing instruments, components, machinery, computers, and telecommunications equipment.

Fiat, through its affiliates, Telettra and SGS, controls sources of electronics technology for application to automobiles and other mechanical production. ITT-Face Standard, although basically a manufacturer of telecommunications equipment, also makes components for its own use and for sale.

These three groups represent exceptions. To date, vertical integration has not been widely adopted in Italy's electronics industry. During the next few years, however, acquisitions, mergers, and other forms of restructuring are expected to result in a more extensive degree of vertical integration than is found today.

Expansion of production, capital investment seen.—The electronics industry contributed an estimated $1.2 billion, or about 1%, to Italy's 1972 gross national product. Production figures in four typical electronics fields for 1971, 1972, and projected for 1973 and 1974, listed in table 3, indicate that most electronics industry sectors anticipate some growth in production.

Table 3.—Italy: Production of semiconductors, computers, consumer radio and television receivers and telephones, 1971-74

Product	Production (in millions of U.S. dollars) 1971	1972	1973	1974
Semiconductors	68.4	67.5	76.0	88.0
Computers and other electronic office machines	132.6	115.6	127.8	130.9
Radios-television (consumer, B/W TV)	262.0	250.0	247.0	245.5
Telephones, professional radios	719.1	822.8	916.3	1,020.0

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

The very strong possibility that color television transmission will not be introduced in Italy for several years has made consumer electronics firms and many of their supplier companies pessimistic about any short-term growth in production and cautious regarding their capital investment plans. Trade sources anticipate, nevertheless, that Italy's overall electronics industry, which had capital investments of $629 million during the 1970-72 period, will increase its capital equipment spending by almost 70% in the 1973-75 period (see table 4).

Most sectors in Italy's electronics industry anticipate that the demand for their products will be modest but steadily increasing during the next few years. Companies manufacturing professional electronics equipment expect demand to increase 10% in fiscal year (FY) 1974, 11% in 1975, and 9% in 1976.

The consumer electronics segment anticipates increases in demand of 3% in FY 1975 and 6% in 1976. Manufacturers of military electronics equipment are looking for a 7% annual increase in demand in both FY 1974 and FY 1975 and a 12% increase in 1976.

Component Manufacturers' Profiles

Most of Italy's leading component manufacturers regard their current level of automation as only a first step toward complete mechanization of their manufacturing processes. The 1973-75 capital investment budgets of three large component manufacturers indicate increases in expenditures for advanced machinery, particularly production equipment.

A major Italian manufacturer of passive components employs approximately 1,440 persons at its factories in Bologna and Pontinia. This firm had a 1972 sales volume of nearly $25 million, with sales of *paper, synthetic film, mica, electrolytic, ceramic,* and *variable capacitors* accounting for about 65% of the total volume and the remainder realized from sales of *relays, motors, positioners, integrated circuits,* and *tuners.*

During the period 1970-72, the company spent about $3.4 million per year for production equipment and an additional $400,000 for test equipment. The firm plans to increase its annual EIPT equipment allocation to over $4.6 million per year between 1973 and 1975.

The manufacturer currently makes extensive use of both large-scale and medium-scale integration in its production operations. Most of the firm's manufacturing processes are now being automated, with emphasis being given to such equipment as riveting machines, embossing machines, micro-materials handling and positioning equipment, and other equpment used in the production of capacitors. The company also plans to computerize its entire manufacturing line and to install some numerical control systems for multiple precision tools.

Table 4.—Italy: Capital investments by the electronics industry and selected industry sectors, 1970-72 and projected 1973-75

(in millions of U.S. dollars)

	1970	1971	1972	1973-75 [1]
Overall electronics and electric industry	190.4	176.8	261.8	1,062.5
Telephonic and professional radio	76.5 [2]	76.5 [2]	110.5 [2]	331.5
Radio-television (consumer, B/W TV)	8.5	8.5	25.5	102.0
Others	105.4	91.8	125.8	629.0

[1] Total 3-year expenditures.

[2] Average single-year expenditures under a multiyear budget plan.

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

A Milan-based component manufacturer, employing 715 workers, produces *tubes, quartz components, paper and electrolytic capacitors, printed circuits, deflection yokes, convergence units, transformers, radio and communications equipment,* and *ultrasonic delay lines.* Its total 1972 turnover was $14 million; sales of passive components accounted for $5.6 million, sales of active components for $4.9 million, and sales of other items, primarily printed circuits, for $3.5 million.

The company has spent about $1.6 million for production equipment and $400,000 for test equipment in each of the past few years. Recent purchases included numerically controlled equipment for various production operations and an $80,000 laser trimming system used in the manufacture of passive components.

The company plans extensive automation of its manufacturing operations and has budgeted about $3.3 million per year for EIPT equipment purchases during the 1973-75 period. This firm now produces integrated circuits using medium-scale integration and plans to introduce large-scale integration in upcoming years.

A leading Italian manufacturer of active components currently employs 1,100 production workers at its plant in Rome and its two plants in Milan. The company's 1972 turnover of $25 million consisted of $5 million from sales of *integrated circuits,* $5 million from *attenuators and related products,* and $15 million from *active and passive components* for the consumer electronics industry.

Of the company's $9 million in EIPT equipment investments between 1970 and 1972, over $8.5 million was for production equipment, with the balance spent on test devices. The company has designated $8 million for additional EIPT equipment during the 1972-75 period.

Medium-scale integration represents the current technological level of production, although large-scale integration is gradually being adopted with satisfactory results. The company's management has initiated an energetic policy of automation that is expected to continue during the next few years. A number of advanced machines have been ordered to augment the firm's micromaterials handling and positioning machines. Other company plans call for the addition of numerical control devices to current equipment.

End-Product Manufacturers' Profiles

Companies in Italy's consumer electronics industry, like component manufacturers, plan substantial increases in their capital equipment expenditures during the 1973-75 period. Two of the major companies anticipate their near-term annual expenditures for electronic equipment to be five times greater than in 1972.

A leading Italian electronics firm manufactures *products for radar, missiles, avionics, telecommunications, data processing,* and other *industrial and military uses.* About 3,000 production workers are employed at the company's manufacturing facilities in Rome and Naples. In 1972, this company realized $5 million from its production of telecommunications equipment, $5 million from data processing equipment, $5 million from automation equipment, and $35 million from all other products.

Capital expenditures in 1972 included $100,000 for wiring equipment, $300,000 for test apparatus, and $550,000 for electronic production equipment, out of the firm's total capital equipment budget of approximately $3.5 million. The company anticipates a dramatic increase in capital equipment expenditures during the 1973-75 period, with an estimated $5 million per year earmarked for purchases of electronic equipment.

A major Italian consumer products manufacturer employs some 2,200 persons at its Lombardy plant for the production of *radios, television sets,* and *tape recorders.* Approximately 20% of the company's activity involves the production of printed circuits, chassis, and other metallic parts for electronic sets, coils, and integrated control systems, with the remaining 80% devoted to equipment assembly. The sale of radios accounted for about one-third of the firm's total 1972 volume of $28 million.

Company expenditures over the next few years for test and manufacturing equipment, particularly for automation machines, may be as high as $9 million. In 1972, the firm spent $100,000 for wiring equipment, $200,000 for test equipment, and $350,000 for manufacturing equipment.

Competitive Environment

The efforts of Italy's electronics industry to reduce production costs by replacing manual processing with automation are resulting in a sharp upswing in the industry's demand for sophisticated production and test equipment. Domestic EIPT equipment manufacturers, whose production is concentrated heavily on conventional machinery and instruments, are not prepared to meet these changing industry requirements. Italian electronics manufacturers can, therefore, be expected to turn increasingly to foreign suppliers, including the United States, Germany, France, Japan, and Switzerland, to satisfy their equipment needs.

U.S.-made EIPT equipment, which already enjoys an excellent reputation among Italian end-users for its design, production capacity, and performance, is expected to gain in popularity as the Italian electronics industry gains in sophistication.

The United States supplied 40%, or $5.2 million worth, of the production equipment sold in Italy in 1972 (see table 5). Sales of test equipment, valued at $900,000 in 1972, represented 35% of Italy's test equipment consumption.

American suppliers should triple the value of their 1972 exports of production equipment during the next 4 years, reaching sales of over $17.5 million in 1977 (see table 6). This would give the U.S. a 60% share of the Italian production equipment market in that year. The $1.7 million in sales of test equipment forecast for U.S. suppliers in 1977 represents an increase of almost 90% over the 1972 level and a 32% share of Italy's 1977 test equipment market.

Consumption of domestically produced EIPT equipment in 1972 totaled $6.6 million, representing 42.3% of Italy's market. Commercial domestic manufacturers supplied $4.7 million (30.1%) of the country's requirements for production and test equipment, with production equipment valued at $3.9 million and test equipment at $800,000.

Local electronics manufacturers, on the other hand, supplied 12.2% of their own production and test equipment needs, producing $1.3 million worth of production equipment and $600,000 worth of test apparatus.

Printed circuit production equipment and test devices represent the bulk of Italy's in-house manufacture of EIPT equipment. Industry sources attribute the rather significant amount of in-house production to the desire of many manufacturers, particularly producers of active components, to maintain industrial secrecy, reduce costs, and obtain equipment geared to their specific requirements.

Approximately 35 Italian firms are producing EIPT equipment, but no firm holds a dominant position in any of the equipment market segments. Most of these firms are small or medium in size,

Table 5.—Italy: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	1.3	.6	1.9
by other firms	3.9	.8	4.7
Imported:			
from the U.S.	5.2	.9	6.1
from other countries	2.6	.3	2.9
Total	13.0	2.6	15.6

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Italian trade source estimates.

Table 6.—Italy: Imports from the United States of electronics industry production and test equipment, 1972 and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	5.2	8.6	17.6
Test equipment	.9	1.1	1.7
Total	6.1	9.7	19.3

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Italian trade source estimates.

and their production is limited almost exclusively to conventional, rather than advanced, equipment.

Two representatives of the local EIPT equipment industry are Argon Service Srl and Pluda Fratelli, both of Milan. In recent years, increased Italian use of printed circuits has boosted the sales of Argon Service Srl, a firm that manufactures printed circuit production equipment and imports test equipment and manual machines for sale to printed circuit manufacturers.

The aggressive sales policy and extensive product line of Pluda Fratelli have earned this firm an increasingly important place among Italy's manufacturers of wiring assembly and interfacing equipment. Pluda Fratelli also imports and distributes wiring assembly equipment, strippers, printed circuit welding machines, and color-coding machines, primarily of U.S. origin.

Italy's equipment imports from countries other than the United States represented 18.5% of the overall EIPT equipment market in 1972. Third country production equipment imports in 1972 totaled $2.6 million, or 20% of the market, and test apparatus imports amounted to $300,000, or 11.5% of the local market.

DECK of West Germany is one of the few suppliers marketing thermocompression and ultrasonic welders in Italy, while Svecia Silkscreen Maschiner AB of Sweden is a large supplier of silkscreen printing machines.

Competition is keen in the market for wiring assembly and interfacing equipment, with Andersen & Nord of Norway, Gytaco-Knu Wyse of Switzerland, Hellermann Electric, Ltd., of the United Kingdom, Meteor AG of Switzerland, Shimeiba of Japan, Ingra of Spain, Invest Export of East Germany, and Mavil S.A., Sercel, and Souriau of France active in this market. Both Klemmt of Germany and Metrix of France are selling test equipment in Italy.

The customs duties levied on EIPT equipment imported into Italy from countries not members of the European Economic Community vary according to equipment type. The average customs duty is about 9% ad valorem. All equipment sold in Italy is subject to a 12% value-added tax which, for imported equipment, is levied on the invoice price of the equipment plus the customs duty. Additional information concerning import duties and regulations may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Room 4217, Main Commerce Building, Washington, D.C. 20230.

U.S. suppliers already active in Italy's EIPT equipment market and those planning to enter the market should be prepared to support their sales efforts with technical expertise. The availability of persons qualified to explain the operation and performance advantages of highly sophisticated equipment could have a strong influence on the choice of a supplier.

In addition, trade sources point out that, in view of the increasing interest in automation and advanced equipment in Italy today, American suppliers might consider presenting seminars, courses, and training sessions for potential customers to inform them of the capabilities of sophisticated EIPT equipment and the types of equipment available.

Technical Requirements

Electric current in Italy is 220 volts, single-phase, 50 hertz. In some areas 380 volts, 3-phase, 50 hertz is available. The metric system of weights and measures is used throughout Italy.

Further information on Italy's technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

The following market research survey is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M Main Commerce Building, Washington, D.C. 20230: "The Market for Electronics Industry Production and Test Equipment in Italy," DIB 74-01-500, May 1973.

Electronics Industry Production & Test Equipment

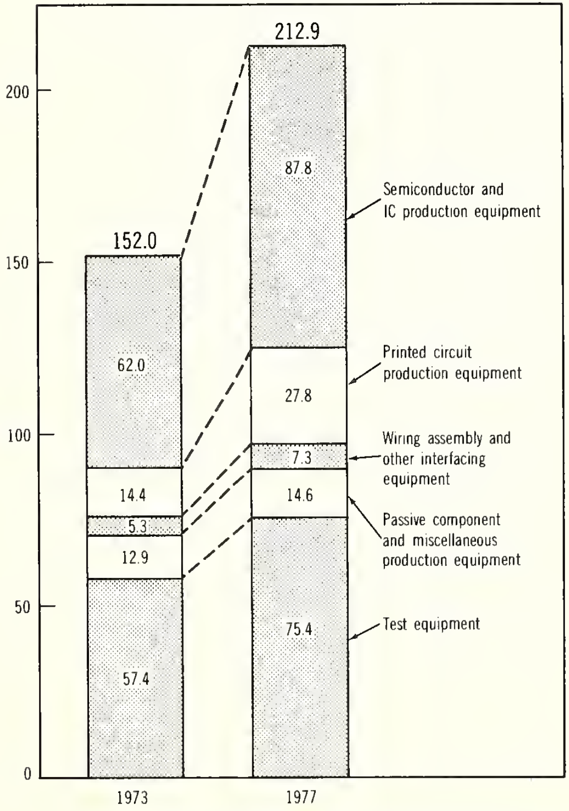
Japan

Strengthened domestic demand for industrial electronic products and components, along with the continuing overseas market for Japanese consumer items, should boost the output of Japan's electronics industry to nearly $19.5 billion in 1975, up 30% from an an estimated $14.9 billion in 1973. An accompanying increase in demand, averaging 8.8% per year, is forecast for electronics industry production and test (EIPT) equipment through 1977.

Japanese consumption of EIPT equipment is projected to rise from an estimated $152 million in 1973 to nearly $213 million in 1977. Investment in production equipment may reach $137.5 million in 1977, while sales of test devices are expected to total $75.4 million.

Japan: Consumption of electronics industry production and test equipment, 1973 and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Japanese trade source estimates.

Two key factors are acting to stimulate Japanese investment in EIPT equipment. First, restrictions on imports of integrated circuits (IC's) and on foreign investment in domestic IC manufacture are scheduled to be lifted in December 1974. The electronics industry's attempt to prepare for the resulting intensified competition in the domestic market is having an immediate effect on EIPT equipment sales. Second, the industry is continuing to seek ways to offset the adverse effects of rising labor costs and recent current realignments on its competitive position in the world market.

Imports are expected to account for 46% (approximately $70 million) of Japan's 1973 requirements for EIPT equipment, while an additional 30% ($45.6 million) should come from domestic suppliers. The remainder will be produced by electronics firms for in-house use.

Japanese customers are expected to import approximately $65 million worth of EIPT equipment from U.S. suppliers in 1973. The failure of domestic firms to offer a sufficiently broad range of EIPT equipment is expected to result in an increase in Japan's dependence on American suppliers. Imports of U.S.-made EIPT equipment are forecast to reach more than $112 million in 1977.

Selected Sales Opportunities

A market survey recently conducted in Japan for the U.S. Department of Commerce, Office of International Marketing, indicated that sales prospects

Japan—Selected Indicators
(1972)

Gross national product:	**$300 billion**
Population:	**105 million**
Total country imports:	**$23.5 billion**
Total country exports:	**$28.6 billion**
Exchange rate (Nov. 1973):	**US$1=268 yen**

are favorable for almost the entire range of EIPT equipment, particularly those items that reduce labor costs. Analysts noted that the electronics industry's investment in capital goods is recovering strongly from the recession which saw consumption of EIPT equipment fall from $133.1 million in 1971 to $97.4 million in 1972 (see table 1).

A list of selected EIPT equipment normally obtained from foreign suppliers, and of some of the items supplied primarily by domestic EIPT equipment manufacturers, is presented in table 2.

Semiconductor and integrated circuit production equipment.—Purchases of equipment for the production of semiconductors and integrated circuits by Japanese electronics manufacturers totaled $36 million in 1972 and were expected to jump to $62 million in 1973. Forecasts for 1977 indicate that this sector of the market should account for sales of $87.8 million in 1977, representing an average annual increase of 9.1% during the 1973-1977 period. Manufacturers are particularly likely to purchase:

- Spray etching machines
- Ion implantation equipment
- Photoresist stripping machines
- Electron beam evaporators
- Automatic loading/unloading equipment for wafer manufacture

Most major semiconductor manufacturers, particularly computer firms making their own components, will expand their facilities for the production of integrated circuits, solid state memories, and LSI. Their choice of EIPT equipment will be influenced by the need to improve the quality and competitiveness of their products in world markets.

Printed circuit production equipment.—The Japanese electronics industry spent $11.8 million for printed circuit production equipment in 1972, and its 1973 investment for such equipment is estimated at $14.4 million. Consumption is expected to rise by an average of nearly 18% a year between 1973 and 1977, reaching $27.8 million in the latter year. Sales prospects are favorable for:

- PC cameras
- Cleaning and drying equipment
- Photoprinters
- Etching machines
- Drilling machines
- Electroplating equipment
- Photoresist systems
- Component inserting and sequencing machines
- Routers and profilers
- Silk screen equipment
- Protective coating equipment
- Multiple slotting machines

The manufacture of printed circuits has in the past engaged a multitude of firms of different sizes and capabilities. Presently, however, the larger electronics firms are cutting back their subcontracting of such work, the rationale being that the manufacture of their own printed circuits makes it easier to maintain quality standards and to control production costs.

As a result, such firms are now in the market for most types of equipment used in printed circuit production, particularly drying equipment, etching machines, drilling machines, and electroplating equipment. Past experience has proven U.S. equipment of these types to be more reliable than domestic products.

Wiring assembly and other interfacing equipment; passive component and miscellaneous production equipment.—Japanese purchases of wiring assembly and other interfacing equipment, along with passive component production equipment, are rising at a lesser rate than expenditures for other types of EIPT equipment. Rising labor costs at home are forcing electronics manufacturers to turn to their offshore subsidiaries or other suppliers in Taiwan, Korea, Hong Kong, and Singapore for passive components and subassemblies that they would otherwise produce themselves.

Japanese manufacturers purchased $3.9 million worth of wiring assembly and other interfacing equipment and $9.5 million worth of passive com-

Table 1.—Japan: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment ..	47.1	36.0	62.0
Printed circuit production equipment	17.6	11.8	14.4
Wiring assembly and other interfacing equipment	4.6	3.9	5.3
Passive component and miscellaneous production equipment..	13.7	9.5	12.9
Test equipment for production/inspection of electronic products	50.1	36.2	57.4
Total	133.1	97.4	152.0

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Japanese trade source estimates.

Table 2.—Japan: Market for selected EIPT equipment, imported and domestic,[1] *1972*
(in millions of U.S. dollars)

	Total purchases 1972	Imported (percent)	Domestic (percent)
Items obtained primarily from foreign sources:			
Photo repeaters	2.0	100	—
Drafting machines	.7	60	40
Mask alignment equipment	1.0	75	25
Other maskmaking equipment	1.5	60	40
Crystal growing equipment	.7	90	10
Epitaxial reactors (C.V.D.):			
silicon	1.0	70	30
GaAsP	.8	60	40
SiO_2	1.0	70	30
others	.7	90	10
Ion implantation equipment	1.0	100	—
Electron beam evaporators	1.6	65	35
Laser scribers	.7	80	20
Drilling machines	1.0	70	30
Photoresist spinners	.9	90	10
Soldering equipment	1.5	60	40
Pattern generators (CAD)	1.0	100	—
IC testers and auto handlers	10.0	80	20
Items supplied primarily by domestic manufacturers			
Reduction cameras	.7	—	100
Conveyor furnaces	1.0	30	70
Diffusion furnaces	5.0	40	60
Screen printers	.7	40	60
Wafer scribers	.7	20	80
Clean benches	7.0	—	100
Etching machines, cleaning	.7	—	100
Welders	.7	10	90
Transfer molding presses	1.0	5	95
Wafer-probing equipment	1.0	20	80

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[1] Excludes equipment manufactured in-house by the end user.
Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Japanese trade source estimates.

Japan's Electronics Industry—Basic Data
(1972)

Total value of production:	**$10.8 billion**
Number of firms manufacturing (1971):	
Semiconductors and integrated circuits—	**63**
Electric and electronic measuring equipment—	**1,106**
Electronic computers and related equipment—	**479**
Radio and television receivers—	**118**
Radio electronic products—	**60**
Total value of components:	**$2.9 billion**
Total value of end products:	**$7.9 billion**
Output of selected products:	
Television receivers—	**$2.4 billion**
Computers and related equipment—	**$1.2 billion**
Telephone equipment—	**$999 million**
Integrated circuits—	**$208 million**
Semiconductors—	**$525 million**

ponent and miscellaneous production equipment in 1972. Such expenditures were estimated at $5.3 million and $12.9 million, respectively, for 1973.

In 1977, the market for wiring assembly equipment is expected to reach $7.3 million, while sales of passive component and miscellaneous production equipment are projected at $14.6 million. This forecast suggests 1973-77 yearly growth rates approximating 8% and 3%, respectively. American EIPT equipment suppliers will find good opportunities to sell:

- Wire-wrap systems
- Automatic reflow soldering systems
- Automatic welding systems

Test equipment for production/inspection of electronic products.—The Japanese market for test equipment totaled $36.2 million in 1972, when demand was unusually slack. Test equipment purchases were expected to jump to $57.4 million in 1973. This sector of the EIPT equipment market should expand at an average rate of more than 7% annually between 1973 and 1977, exceeding $75 million in 1977.

Japanese manufacturers are mainly interested in purchasing test equipment that offers flexiblility and a variety of options. U.S. exporters will find good opportunities to sell the following:

- Integrated circuit test equipment
- Transistor test equipment
- Diode test and classifier equipment
- Resistor test equipment
- Relay test equipment
- Wiring test equipment
- Printed circuit board testers
- Environmental test chambers
- Chip evaluation equipment
- Digital systems analyzers
- Wafer-probing equipment
- Wire bond testers
- X-ray inspection equipment

Japanese EIPT equipment makers have not developed general-purpose testers for integrated circuits, semiconductors, and other components, nor have they been able to keep up with the continuously expanding demand for special-purpose test equipment. Most test equipment of domestic manufacture has been designed by computer manufacturers for specialized use.

This trend, combined with the generally inadequate level of capital investment in research and development and the limited size of the market for any given item, makes it unlikely that Japan will soon reduce its dependence on U.S. test equipment suppliers.

The Electronics Industry

Japan's electronics industry faces dual challenges during the mid-1970's. First, its competitive advantage in world markets is being eroded by skyrocketing labor costs and the recent currency revaluations. Secondly, the Japanese Government is liberalizing the protectionist measures that have effectively shielded the electronics industry during its growth period. Japan's response to this new set of circumstances will certainly emphasize the rationalization and automation of production processes and, therefore, lead to increased investment in EIPT equipment.

Corporate giants dominate industry.—Most of Japan's electronics manufacturers are either subsidiaries of or otherwise affiliated with one of the "big six" holding companies: Hitachi, Ltd.; Tokyo Shibaura Electric Co., Ltd. (Toshiba); Mitsubishi Electric Corporation; Fuji Electric Co., Ltd.; Matsushita Electric Industrial Co., Ltd.; and Nippon Electric Co., Ltd. These holding companies are broadly diversified and manufacture a wide range of electronic products.

Smaller corporate groups, such as Sony Corporation; Sharp Corporation; Tokyo Sanyo Electric Co., Ltd.; and Oki Electric Industry Co., Ltd., produce a more limited range of products but nevertheless play important roles. Leading independent manufacturers include Yokogawa Denki Seisakusho Co., Yamatake-Honeywell Co., and Shimazu Seisakusho Co., Ltd.

Japanese output of electronic products in 1973 was estimated at $14.9 billion, nearly 38% above 1972's level of $10.8 billion (see chart). This increase demonstrates the extent of the industry's recovery from the country's 1971-1972 recession. Consumer electronics led the way, accounting for $6 billion of total production. The output of the industrial electronics sector was estimated at $4.9 billion, while the value of components and parts production was estimated at $4 billion.

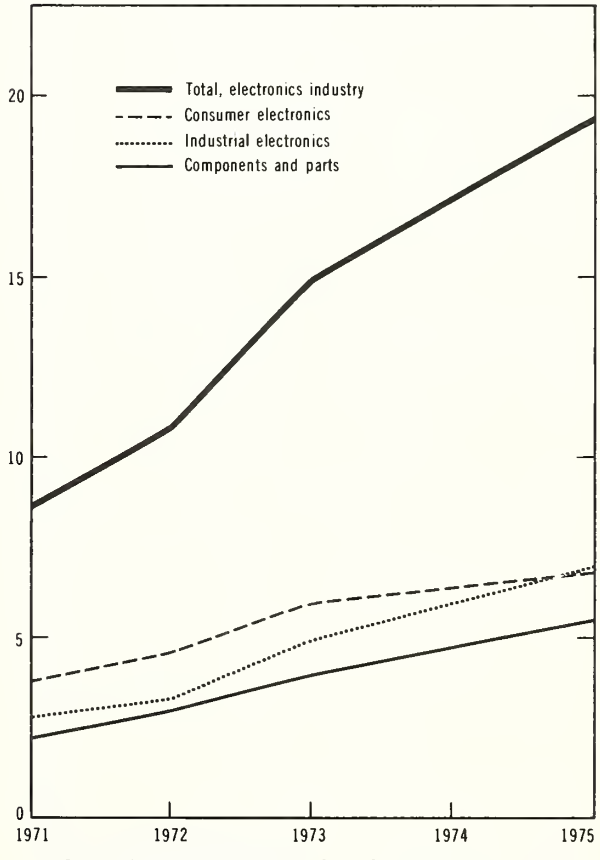
Manufacture of semiconductors was estimated to have reached $753 million in 1973, about 43% about 1972's output of $525 million. In the same period, integrated circuit production rose from 201.4 million units (valued at $208 million) to an estimated 260.4 million units (valued at $338 million).

Output of television receivers in 1973 was estimated at 13.7 million units, consisting of 8.4 million color sets and 5.3 million monochrome sets, with a total value of more than $3 billion. It was estimated that nearly $2 billion worth of computers and related equipment was produced in 1973, while output of tape recorders likely passed the $1.2 billion mark.

Industry relies on foreign technology.—U.S.-based companies have played a major role in the development of Japan's electronics industry since the early 1950's. The American influence has been exerted through joint ventures, licensing agreements, the establishment of manufacturing subsidiaries, and through large volume U.S. purchases of components and subassemblies made in Japan according to U.S. specifications.

Participation by other foreign countries has been negligible. As of March 1973, of the 58 joint ven-

Japan: Output of electronic products by major category, 1971, 1972, and projected 1973—75 (in billions of U.S. dollars)



Source: Denshi (Electronics), Vol. 13, No. 3, published by the Electronic Industries Association of Japan.

tures in the electronics industry approved by the Japanese Government, 52 were with U.S. companies. The remaining six involved French, Swiss, Dutch, British, and German firms.

Besides establishing joint ventures, U.S. interests have made substantial direct investments in Japanese corporations. General Electric Co., for example, is the principal shareholder in Toshiba. Westinghouse Electric Corporation is the third largest stockholder in Mitsubishi Electric Co., Ltd. Moxley and Co. owns more than 10% of Matsushita Electric Co., and Raytheon Co. holds over 5% of the outstanding stock in Japan Radio Co.

Licensing agreements have been Japan's principal means of obtaining or upgrading its electronics technology. Isolated from the mainstream of world science and technology during the 1940's, and receiving relatively little stimulus from Government-sponsored research and defense-related procurement through most of the 1950's, the electronics industry has had to rely mainly on sales revenue to finance research and development projects. Consequently, not enough money has been available for such purposes.

Most companies stress applied, rather than basic, research. Of the $633 million spent for research in 1970, only 6.7% went for basic research, while applied research and applied development studies received 29.4% and 63.9%, respectively.

Most of the important technologies, such as semiconductor technology, have been imported under technical licensing agreements. The larger American companies have offered their patented know-how to Japanese industry in this way. U.S. firms were partners in 408 of the 484 licensing agreements approved by the Japanese Government in the field of electronics between 1969 and 1971.

Consumer electronics technology thriving.—As Japan's electronics industry gained momentum in the mid-1950's, becoming a major employer and a leading source of foreign exchange, the Government realized the necessity for devoting more resources to research and development and relying less on the purchase of foreign technology. In 1957, Japan enacted legislation entitled "Temporary Law for Strengthening the Electronics Industry," hoping that by 1964, when this program of Government subsidies for R&D was to expire, industry would be ready to assume a greater share of the burden.

The consumer electronics sector did improve its competitive position in world markets, but progress in industrial electronics was disappointing. A 7-year extension of the 1957 act did little to redress the imbalance between Japan and the United States in the development of industrial electronics technology. The leading Japanese companies continued to give priority to consumer electronics, where sales were booming and profits were high.

Meanwhile, the Japanese Government became the target of mounting pressure from other countries, including the United States, to liberalize import restrictions and permit a freer flow of foreign capital into those areas of electronics manufacturing that had hitherto been effectively sheltered from foreign competition. Once the decision was made to move toward greater accommodation of foreign enterprises, Japanese policymakers turned their attention to further bolstering the technological capabilities of domestic producers.

A new law, called the "Temporary Law for Strengthening Selected Electronic Equipment Industries," was enacted in 1971. It sets forth a precise, step-by-step series of technological goals that the Government, acting through the Ministry of International Trade and Industry (MITI), hopes to attain by 1977.

These goals are described in terms of detailed lists of end-product and component production facilities to be set up and specific hardware items to be developed for manufacture on a commercial scale. The desired level of production to be attained by the end of a specified goal year is given for each item.

An additional list suggests plant facilities to be modernized and specific production cost reductions to be achieved in various goal years. For example, by 1977 integrated circuit production costs are to be reduced by 50 to 80% from their 1970 level. MITI estimates that an investment of $264 million on equipment—consisting of 2,060 units of IC production equipment, 200 units of substrate preparation equipment, 820 units of test equipment, and 160 units of other equipment—might be necessary to achieve such a cost cut.

The 1971 legislation includes a budget indicating that Government and industry together will spend in excess of $1.4 billion on R&D in 15 different areas of electronics between 1971 and 1977. Public funds are to serve as a catalyst triggering expenditures by private industry. As table 3 indicates, 67% of the budget is to be spent on R&D for high-capacity digital electronic computers.

The Government share of the above budget is being allocated in three ways: in grants to private companies; in grants to research institutes; and, to a very limited extent, for special studies of American and European methods of R&D management.

In the first instance, the Government uses subsidies to encourage selected firms to compete for R&D contracts or to form joint research teams. Such appeals to corporate pride have been quite successful in inducing manufacturers to spend more of their own money on R&D; the percentage of Government money involved in these projects is relatively modest. These grants exceeded $2.1 million in 1972 (see table 4).

Table 3.—Japan: Anticipated budgetary expenditures by government and industry for electronics research and development, 1971-77

(in millions of U.S. dollars)

R&D programs	Suggested budget
High-capacity digital electronic computers	$962.3
Communications equipment, including opto-electronics (laser beam communications and facsimile transmission)	111.7
Electronic equipment for use in aviation and space	71.6
Parts for circuits, printing of circuits, and components	59.6
Educational electronic devices, including CAE	57.0
Integrated circuits	55.2
Other	118.7
Total	1,436.1

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

Wholly Government-funded research is carried out by MITI at its own industrial technology laboratory and at a research institute managed by the Japan Society for the Promotion of the Machine Industry (JSPMI).

Although most of the ongoing programs for strengthening the electronics industry are covered by the legislation described above, major R&D efforts also are being carried out under a 1966 law entitled "Law for Large Scale Research Projects." Under this program, MITI awards contracts to private companies for a range of different types of hardware.

In electronics, the most important effort under this law is a computer project that aims to develop a high-capacity central processing unit. After 6 years of effort and an expenditure of about $37 million, this program is nearly complete. Subprojects completed under this program include the development of high-speed logic LSI's, the development of IC memories (MOS) and high-speed wire memories, the development of a large-capacity magnetic disc, and the establishment of technology in ultra-high-speed logic circuits.

A second major effort under the 1966 law consists of developing a pattern information processing system. This program, scheduled for completion in 1978, will cost about $130 million.

Japan relaxing protectionism.—The protection given to integrated circuit manufacture, which had been the most effective of the Government policies designed to bolster the electronics industry, has been substantially reduced. This protection took the form of import quotas on IC's of 100 or more elements and of limits on foreign investment in IC manufacturing. The import quotas on IC's of up to 200 elements were removed in April 1973, and the Ministry of Finance has recommended that the remaining restrictions be completely abolished by December 1, 1974.

Manufacturers have asked the Government to cushion the blow with grants of funds to be used for the modernization of production facilities and for further studies in the technology of IC manufacture. Funds in the amount of $11.3 million for the fiscal year ending April 30, 1974, and $15.1 million for the following fiscal year already have been approved.

Vertical integration increases. — Japan's electronics manufacturers have always relied on a network of subsidiaries and subcontractors for most of their components and subassemblies, exercising rather tight control over these smaller firms by means of banking and other connections. The advent of highly complex and specialized electronic components, however, has increased the extent to which the major firms produce their own components and subassemblies.

Beginning with the introduction of integrated circuits in the late 1960's and accelerating with the subsequent appearance of LSI, the larger companies found it more efficient to produce such components in-house rather than depend on subcontractors.

The leading electronics manufacturers have improved their financial condition by gaining control of a stage of production where value added, and consequent profit, are relatively high. The trend toward greater vertical integration will continue as the need for cost reduction of high production runs dictates the application of automation techniques into the manufacturing process.

Table 4.—Japan: Government grants for electronics industry research and development projects, by subject, 1969-72

(in millions of U.S. dollars)

Equipment	1969	1970	1971	1972
Computers	.535	.743	2.030	.892
Automation control equipment	.150	.155	.173	—
Communications equipment	.050	.026	—	—
Electronic equipment for traffic control	—	—	—	.047
Electronic measuring equipment	.108	.017	.058	.230
Industrial electronic equipment	.449	.072	—	—
Electronic medical equipment	—	.211	.032	—
Components and materials	.535	.860	.221	.676
Other	—	—	—	.290
Total	1.827	2.084	2.514	2.135

Source: Electronics Industry Year Book, Dempa Shimbun Press.

Labor supply tightens.—Recruitment of skilled labor is becoming a serious problem for small and medium-size firms in the electronics industry and in other sectors of Japanese industry. It is estimated that in 1972 industry as a whole had a shortage of 1.4 million skilled workers; 74% of this shortage was reported by companies employing 100 persons or less. The larger manufacturers have yet to feel the pinch, since their prestige and generally better working conditions continue to attract qualified workers.

The shortage of skilled workers is largely attributable to a substantial drop in the number of junior and senior high school graduates entering the workforce, due primarily to the effects of population control programs instituted years ago.

Capital investment to rise sharply.—To fortify themselves against the impending liberalization of IC imports, the lifting of restrictions on foreign investment in IC manufacturing, and the rapid rise in labor costs, Japan's electronics firms are planning to step up their purchases of EIPT equipment. Investment by the electric and electronics industries in plant and equipment, which lagged in 1971 and 1972, is expected to approach $1.57 billion in 1977, close to 68% above the estimated 1973 level of $934 million. This substantial increase reflects an average annual growth rate of nearly 14%.

About 55% of the 1977 investment will be used to finance manufacturing facilities for industrial electronic products, consumer electronic products, and electronic components. Approximately 20% is tentatively earmarked for heavy electric machinery. The remaining 25% would be spent for nonmanufacturing facilities and for electrical equipment production.

As table 5 indicates, capital investment in electronics dipped sharply in 1971 and 1972 but experienced a vigorous recovery in 1973. The Japanese economy was shaken in 1971 and again in 1972 by currency revaluations which narrowed the country's price advantage in the United States, its major export market.

By the spring of 1973, however, it appeared that the most drastic currency realignments had already taken place and that future adjustments would be modest. Viewing the generally rising world demand for integrated circuits and components and realizing the urgent need to improve their competitive position, Japanese industrialists have activated retooling and expansion plans. However, the major exporters of electronic end-products are evaluating the advantages of setting up assembly plants in their principal markets rather than shipping the finished product to those countries.

Table 5.—Japan: Investment by the electrical and electronics industries

(in millions of U.S. dollars)

1970	1971	1972	1973	1977
712.8	560.3	586.5	934.0	1,566.0

Sources: Japan Development Bank, 1970-72. MITI projections, 1973 and 1977.

Domestic needs spur production.—Japan's total 1975 output of electronic components and end products is forecast at $19.5 billion, about 30% above the estimated 1973 level of $14.9 billion. During these next few years, most of the impetus for increased production will come from the domestic market. Foreign demand, the industry's traditional mainstay, has stabilized at least temporarily; no significant increases in exports are predicted for the 1973-75 period.

The relative importance of the consumer products sector of the electronics industry is declining. Forecasts for 1975 suggest an output of $6.7 billion, which would be less than 35% of total electronic production, as compared with 43.7% in 1971.

Demand for consumer electronic products was sluggish in 1971 and 1972 but picked up in 1973. It is expected to level off between 1973 and 1975, reflecting the approaching saturation of the domestic market for television sets. Manufacturers are aware of the market potential of video tape recorders/players and four-channel audio equipment and are optimistic about the long-term outlook for the consumer electronics industry.

Japanese output of industrial electronic products has been growing rapidly and is likely to rise by an average 19.5% during the 1973-75 period. Table 6 indicates the direction this growth is taking.

Japan's determined pursuit of both the domestic and world computer markets is the most important factor behind the growth of the industrial electronics sector. Output of computers and related equipment, estimated at nearly $2 billion in 1973, may rise by 60% to $3.2 billion in 1975.

Through generous subsidies, MITI has convinced the six major computer manufacturers to form three partnerships for the research and development of hardware and software. Each of these teams will specialize in certain types of electronic data processing equipment.

Demand for telecommunications equipment is also strong. There are long waiting lists for business and residential telephones, and computer users are clamoring for more extensive data transmission networks. All along, developing nations have been steady customers for Japanese-made telephone-switching, microwave, and cable installations.

Japanese production of electronic components was estimated to have reached $4 billion in 1973, a substantial increase from the $2.9 billion achieved in

Table 6.—Japan: Output of industrial electronic products, 1970-75
(in billions of U.S. dollars)

	1970	1972[1]	1973[2]	1975[2]
For commercial and industrial use	1.6	2.2	3.3	4.9
For government use				
telecommunications	.6	.7	1.0	1.3
military	.1	.2	.2	.3
other	.2	.2	.4	.5
Total, government	.9	1.1	1.6	2.1
Total output	2.5	3.3	4.9	7.0

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[1] Preliminary figures.
[2] Projected figures.
Source: Japan Electronics Machinery Manufacturers Association.

1972. The forecast for 1975 is for an output of $5.6 billion. Semiconductor manufacturers received a needed boost from the boom in sales of compact and pocket-size electronic calculators. They pin their hopes for the future on the adaptation of integrated circuits to wristwatches and automotive equipment.

Component manufacturers in general, however, express only guarded optimism about the future, mainly because rising labor costs have made the manufacture of such items as resistors, capacitors, coils, and speakers uneconomical in Japan. The larger component firms are setting up overseas facilities, leaving behind surplus production capacity and a tough competitive situation for the smaller firms.

Concerned about this trend, MITI is attempting to guide component manufacturers toward new areas of research and development and may offer financial assistance during the transitional period.

Wage hikes lead to automation.—Japanese electronics manufacturers are interested in purchasing EIPT equipment that can help them combat rapidly rising labor costs. The industry saw wages rise by as much as 15.8% in 1972, while productivity increased by 14.8%. Wages in 1973 were estimated to have risen as much as 20.5%, further widening the gap. The failure to increase productivity in proportion to wages is the industry's primary concern.

Many efforts are being made to reduce labor costs. The Japan Society for the Promotion of the Machinery Industry, a nonprofit association subsidized in part by MITI, has made studies of the potential reduction in man-hours that could be achieved by automating specific production processes, such as the manufacture of hybrid integrated circuits.

Component Manufacturers' Profiles

Three of Japan's leading component manufacturers are described below. All belong to major corporate groups and, together with subsidiaries and affiliates, produce a wide range of electronic end products, as well as components. Each places high priority on modernizing plant facilities and automating production to the fullest extent practical, moving toward computerization of individual assembly stages using minicomputer-controlled closed-loop systems with feedback. Their production methods do not differ markedly from those of American manufacturers, although wafer production is semiautomated and employs manual labor to a greater extent than in the United States. Wire-bonding is also a manual operation. LSI production is automated in most cases; however, circuit boards are generally drilled by hand.

Hitachi, Ltd. manufactures *transistors, diodes,* and *IC's* at four plants which together employ more than 6,000 workers. During the year ended September 30, 1972, Hitachi produced $59 million in discrete components, $36 million in integrated circuits, and $24 million in LSI.

Hitachi's total stock of EIPT equipment carries a book value of $169.6 million. The four component factories account for $21.8 million of this total, comprising over $15 million in production equipment and $6.7 million in test equipment. Hitachi investments in equipment of all types is estimated at $98.1 million in 1973, of which $11.3 to $15.1 million will probably be used to raise production of semiconductors to an annual level of about $190 million. The remainder will be invested in production facilities for consumer electronics and for computers and related equipment, as well as for plant modernization and laborsaving equipment in general.

Nippon Electric Co., Ltd., makes approximately $38-million worth of *discrete components,* $22-million worth of *integrated circuits,* and $15-million worth of *LSI* annually, in addition to a variety of end-products. This firm has 37,000 employees, 14,209 of whom work at the two plants that mainly produce components. These plants are equipped with $17.4 million in production equipment and $93.6 million in test equipment.

NEC was slated to invest a total of $83 million in equipment of all types in 1973, a 30% rise over its 1972 expenditures for such purposes. A program of decentralization of production facilities, begun in 1964, was to have been completed by year-end 1973 with the inauguration of an $11.3-million capacitor and variable resistor factory. Future investment outlays will stress the addition of new product lines and the modernization of existing plants.

Fujitsu, Ltd. is Japan's leading maker of *numerical controls* and an important manufacturer of *electronic components.* Its yearly output of discrete components approximates $23 million, while production of IC's and of LSI is valued at $16 million and $7 million, respectively. More than 7,000 workers are employed at the four plants which primarily make electronic components. These factories are equipped with $8.6-million worth of EIPT equipment, of which $6 million is production equipment. Fujitsu scheduled massive increases in capital investment for 1973. Out of a total investment budget of $132 million, more than $29 million was intended for expansion of component production facilities, including $19 million for IC-related facilities.

End-Product Manufacturers' Profiles

Japan's leading makers of television receivers are described below. These two firms also rank high in several other fields, notably semiconductors and other components. Both companies report that approximately 70% of their annual operating budget is spent on assembly, while 30% is allocated for manufacturing. Each expects its capital investment outlays to rise by 20 to 30% annually in 1974 and succeeding years.

Tokyo Shibaura Electric Co., Ltd., commonly known as Toshiba, makes a vast variety of electronic and electronic-related components and end-products ranging from light bulbs to power plants. Toshiba's 1972 output of nearly $2 billion consisted of $804 million in consumer products, $625 million in communications and electronic devices, and $535 million in heavy electrical machinery. Its 1972 capital investment outlays totaled $102 million, and plans called for $121 million to be spent in 1973. Toshiba's 30 electronics subsidiaries supply a substantial portion of the parent firm's requirements for materials, components, subassemblies, and end products.

Matsushita Electric Industrial Co., Ltd., which markets its consumer products in the United States under the brand name "Panasonic," has 90 subsidiaries, 20 of which are electronics- related. During the 12-month period ended in May 1972, Matsushita's production exceeded $3 billion, of which communications and industrial electronic devices accounted for $1.7 billion and consumer products for $925 million. Matsushita budgeted $90.6 million for capital goods in 1973, about 40% more than it spent in 1972. Much of this was used for plant modernization.

Competitive Environment

Domestic manufacturers of EIPT equipment, including those manufacturing equipment for in-house use, are estimated to have accounted for 60% of the Japanese market for production equipment in 1972 and slightly more than 40% of the market for test apparatus (see table 7). These shares are expected to drop to about 50% and 35%, respectively, between 1973 and 1977.

The proportion of Japan's total EIPT equipment needs that are met by in-house manufacture is likely to remain rather stable, while the percentage share of the market supplied by Japanese firms on a commercial basis will probably decline, rather drastically so in the case of test equipment.

Table 7.—Japan: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced			
by end-user	16.1	7.3	23.4
by other firms	20.9	8.1	29.0
Imported			
from the U.S.	21.5	20.4	41.9
from other countries	2.7	.4	3.1
Total	61.2	36.2	97.4

Source: U.S. Department of Commerce, Bureau of International Commerce, market research study. Values based on Japanese trade source estimates.

Approximately 65 Japanese companies manufacture EIPT equipment on a commercial basis. Their 1972 sales were estimated at close to $21 million for production equipment and slightly over $8 million for test equipment. Such sales are expected to increase to $36.2 million and $9.3 million, respectively, in 1977.

Many electronics firms, particularly computer manufacturers, make EIPT equipment for their own use. The value of such in-house manufacture in 1972 was estimated at more than $16 million for production equipment and $7.3 million for test equipment; projections to 1977 show these values rising to $33.1 million and $17.9 million, respectively.

The industry, which excels in the manufacture of reduction cameras, clean benches, transfer molding presses, and wiring equipment, seems to be making little progress in producing a general-purpose tester for IC's, semiconductors, and other components.

U.S. supplies 93% of imports.—Japanese manufacturers apparently feel no pressing need to avoid substantial dependence on foreign—in effect, American—EIPT equipment suppliers. They are more concerned at present with meeting stiffer foreign

Table 8.—Japan: Imports from the United States of electronics industry production and test equipment, 1972, and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	21.5	47.2	65.0
Test equipment	20.4	35.0	47.3
Total	41.9	82.2	112.3

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Japanese trade source estimates.

competition in the manufacture of electronic components rather than with tooling up for the manufacture of specialized equipment.

The United States supplied 43% of Japan's EIPT equipment market in 1972, recording sales of $41.9 million, of which $21.5 million was production equipment and $20.4 million was test devices (see table 8). American EIPT equipment exporters should be able to boost their overall share of the market to 53% by 1977. Such an increase would yield sales of more than $112 million—$65 million in production equipment and $47.3 million in test equipment.

Five of Japan's EIPT equipment manufacturers are licensees of U.S. firms and four of these are joint ventures in which the American manufacturer has substantial financial interest. High labor costs make it unlikely that Japanese companies will seek additional licensing agreements covering the manufacture of EIPT equipment, or that U.S. firms will significantly increase their direct participation in Japanese EIPT equipment manufacture.

The Nichiden-Varian Co., Ltd., in which the U.S. firm Varian Associates has a 50% equity, makes electron beam evaporators, vacuum evaporators, and sputtering equipment, exporting a fraction of its output to Southeast Asian countries. Nichiden-Varian has an approximate 40% share of the Japanese market for sputtering equipment and a 20% share of the market for electron beam evaporators.

TEL-Thermco Co., Ltd., in which The Thermco Products Co. of the United States has a 47.5% share, makes semiconductor diffusion furnaces for the Japanese market and has exported some of these furnaces to Taiwan.

Lindberg-Tempress Co., Ltd., is a subsidiary of a joint venture company in which Sola Basic Industries, Ltd., of the United States has a 50% interest. Lindberg-Tempress makes semiconductor diffusion furnaces, but its share of the Japanese market is small. The firm may begin exporting furnaces to customers in Southeast Asia.

The Nippon-Aviotronics Co., Ltd., in which the Hughes Aircraft Co. holds 49% of equity, accounts for approximately one-third of Japanese production of flip chip bonders. Nippon-Aviotronics does not presently export EIPT equipment.

The Kokusai Electric Co., Ltd., a wholly Japanese-owned company, is licensed by Hughes Aircraft to make flip chip bonders. Its position in this sector of the market is second only to Nippon-Aviotronics, mentioned above. Kokusai manufactures a variety of other EIPT equipment, notably chemical vapor deposition equipment, wafer probers, and conveyor furnaces. The firm is Japan's leading maker of diffusion furnaces.

Other foreign suppliers of EIPT to Japan accounted for only $3.1 million in sales in 1972. Taylor Hobson, of the United Kingdom, is the most active European EIPT equipment supplier to the Japanese market.

Import duties reduced.—Japanese customs duties applicable to imports of EIPT equipment currently range from 6 to 12%, reflecting the recent 20% reduction in the tariffs levied on most of the items in this category. However, equipment which is linked with a computer, such as certain testing equipment or numerically controlled production equipment, is subject to an import quota. Each case is reviewed separately, but imports of computerized EIPT equipment have so far rarely been permitted entry. Additional information concerning import duties and regulations may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration (Room 4217), Washington, D.C. 20230.

Technical Requirements

The characteristics of Japan's electrical supply are 100 volts, 50 hertz in northern Japan, including Tokyo, and 100 volts, 60 hertz in other regions. Installations of 200, 3,000, and 6,000 volts are also available, with a trend toward the use of 6,000-volt lines for industrial and other major customers.

Japan uses the metric system of weights and measures exclusively. Indicating devices must, according to law, be calibrated in metric units. Such equipment may be sold in Japan only when both the distributor and supplier are registered with the appropriate Government agency and when the device has been approved by an official testing authority.

Interested parties may obtain additional information on Japanese technical standards from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

The following market research study is available from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M Main Commerce Building, Washington, D.C. 20230:

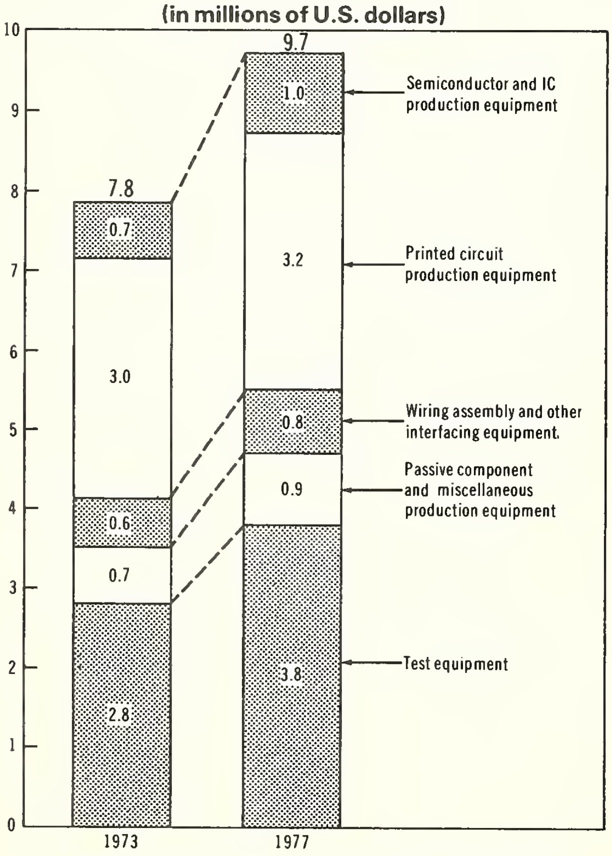
"The Market for Electronics Industry Production and Test (EIPT) Equipment in Japan," DIB 73-09-502, May 1973.

Electronics Industry Production & Test Equipment
Netherlands

The Dutch electronics industry began to expand in mid-1972 following a recession in 1970-71. Investment in electronics industry production and test (EIPT) equipment is showing new strength, with the emphasis on test apparatus and specialized printed circuit production equipment. Dutch electronic component and end-product manufacturers have purchased, or manufactured for in-house use, an estimated $7.8 million worth of EIPT equipment in 1973. This represents an 11% increase over 1972 consumption of $7 million and a 56% jump from the 1971 market of $5 million (see table 1).

Netherlands: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: Values based on U.S. Department of Commerce, Bureau of International Commerce, estimates and projections.

Market analysts estimate that in 1973 the Dutch electronics industry will invest $3 million in printed circuit production equipment, $2.75 million in test equipment, $700,000 in semiconductor and integrated circuit (IC) production equipment, $650,000 in wiring assembly and other interfacing equipment, and $700,000 in passive component and miscellaneous production equipment.

The 1973-77 period should see the Dutch market for EIPT equipment expand at an average annual rate of 5.6%, reaching a level of $9.7 million in 1977. The market for test equipment looks especially promising, as the Dutch are expected to invest heavily in test apparatus to inspect imported components. Sales of test equipment should rise by nearly 9% annually between 1973 and 1977, reaching almost $4 million.

U.S. manufacturers of EIPT equipment supply approximately 45% of the Netherlands market for production equipment and 65% of the market for test equipment. In 1972, U.S. sales are estimated to have totaled $3.6 million, while European and Japanese sales are believed to have been $1.7 million. The position of American exporters of EIPT equipment seems secure, due to their reputation for producing high quality products and their extensive selection of advanced and specialized equipment.

Selected Sales Opportunities

A market research study recently conducted in the Netherlands for the Office of International Marketing of the U.S. Department of Commerce re-

Netherlands—Selected Indicators
(1972)

Gross national product:	**$45.6 billion**
Population:	**13.3 million**
Total country imports:	**$14.2 billion**
Total country exports:	**$14.1 billion**
Exchange rate November, 1973:	**2.67 guilders = US$1**

vealed favorable sales opportunities for U.S. manufacturers of:

- Multilayer printed circuit production equipment
- Transistor test equipment
- Diode test and classification equipment
- Wiring test equipment
- Printed circuit board testers

The Electronics Industry

The Netherlands is plagued with a high rate of inflation. Rising wages have propelled prices upward, thereby reducing the competitiveness of many Dutch-made goods both at home and abroad. The electronics industry has partially met this challenge by importing components from countries such as Singapore and Taiwan, where labor costs are lower. Philips, the leading Dutch electronics manufacturer, is reorganizing its entire structure and shifting production of certain products to other countries in Europe. Philips and others in the Dutch industry are expected to adopt long-overdue automation in production processes. Investment in EIPT equipment should, therefore, increase. Although customer interest may at first center on test equipment for inspection of imported components, advanced production equipment will assume greater importance in the long run.

Philips dominates industry—Philips Gloeilampenfabrieken N.V., an electronics manufacturer based in Eindhoven, is the third largest industrial corporation headquartered outside the United States. Except for a few Dutch subsidiaries and affiliates of U.S. firms, most of the Netherlands' hundred or so smaller electronics manufacturers and assemblers produce primarily on subcontract to Philips. A number of these firms are also Philips' subsidiaries.

Approximately 100,000 workers are employed at the more than 30 Philips offices and plants located in the Netherlands; an additional 250,000 work for Philips' subsidiaries in Europe, the United States, and elsewhere. The global scale of Philips' production and marketing operations means that decisions affecting the firm's Netherlands division, and hence the investment in capital equipment for its Dutch factories, are based on considerations which may have little to do with conditions within the Netherlands itself.

The only major Dutch producer of electronic components is Philips' ELCOMA Division. This firm, with 3,000 to 5,000 workers at its Netherlands plants, makes medium-scale integrated circuits, printed circuits, and passive components.

The industry's 1973 consumption of semiconductors has been estimated at 60 million units (valued at $30 million), up 7% from 56 million units (worth $23 million) in 1971. The 1975 Dutch market for semiconductors is forecast at 66 million units, or about $34 million.

Approximately half of the industry's semiconductor needs are met by domestic manufacturers. Most of this production consists of the simpler types of IC's. Dutch electronics firms usually obtain the more complex, custom-designed IC's from foreign sources. Three companies—Philips ELCOMA and two U.S. affiliates, Tektronix N.V. and Nederlandsche Standard Electric Mij. ITT—account for the bulk of semiconductor consumption.

Philips is the Netherlands' only major manufacturer of consumer electronic products. Its TV production facilities in Germany and Belgium, as well as those in the Netherlands, manufacture at least 50% of the television sets bought by the Dutch and 30% of those sold in Western Europe.

Dutch manufacture of industrial electronics products is also dominated by Philips, although a number of small independent firms have earned international reputations for the production of high-quality engineering, scientific, and medical instruments. There are at least 10 manufacturers of electronic medical equipment reporting annual sales of $1 million to $3 million. These include two Dutch companies, Loos and Enraf-Nonius, and the following American-owned companies: Godart-Statham, Gebr. Mijnhardt, Medtronic, Nuclear Chicago Europa, Cordis Europa, and Packard Instruments.

Philips is the only Dutch firm making computers. The 60 systems it is estimated to have produced in 1972 are said to be similar to the IBM 360/30. As of December 1972, Philips had installed a number of systems in its offices and factories and sold 117 systems to other firms. Computer manufacture is not yet a profitable activity for Philips, but in cooperation with Siemens of Germany and Compagnie Internationale pour l'Informatique (CII) of France, the firm hopes to challenge American supremacy in Europe's computer market.

Communications equipment, for which the Dutch PTT (Posts, Telegraph, and Telephone) system is the principal customer, is manufactured in the Netherlands by Standard Electric and Philips Telecommunicatie Industrie.

Philips provided the hardware for the Netherland's first semielectronic telephone exchange and expects to supply similar equipment for additional exchanges to be cut over at the rate of 8,000 subscriber lines per year in 1973-75 and 40,000 lines lines annually thereafter. Philips has also been very successful in marketing PABX hardware for private telephone exchanges.

Holland Signaal Apparaten, a member of the Philips group, is the country's leading manufacturer of radar equipment. Employing 2,500 workers, the company has not found it practical to automate the manufacture of any of its limited production series but does spend large sums on EIPT equipment, particularly manual wiring equipment.

Research and development, with current emphasis on three-dimensional radar needed by the North Atlantic Treaty Organization (NATO), is an important part of Holland Signaal's activities.

U.S. electronics firms are active in the Netherlands, marketing electronic data processing equipment, components and accessories, communications equipment, and engineering and scientific instruments, mostly through agents or sales subsidiaries. Only two firms—Tektronix and Standard Electric-ITT—have established large manufacturing subsidiaries in the Netherlands. Recently, however, a greater number of American electronics manufacturers have been acquiring controlling interests in small Dutch electronics firms.

The nature and extent of vertical integration in the Netherlands electronics industry varies with the type of product being manufactured. In general, the manufacture of high-volume items and specialized components is highly integrated. Philips, however, is able to change its strategy from time to time to take advantage of the lower prices that independent suppliers may sometimes offer.

There is no shortage of skilled labor in the Netherlands, though the economy has operated at nearly full employment during most of the postwar period. The industry was forced, however, to import large numbers of unskilled workers from Spain, Italy, Turkey, and other foreign countries. This recruitment was sharply curtailed during the 1970-71 recession; in fact, many of the laborers were sent home.

The Government of the Netherlands has taken no steps designed specifically to strengthen or support the country's electronics industry. It does, however, offer tax incentives and liberal credit arrangements to all companies who set up factories in regions troubled with persistent structural unemployment. Industry, rather than government, is the main source of grants to universities and technological institutes for basic research. Some of these educational institutions have small electronic production units.

Outlook for electronics industry mixed.—The Netherlands electronics industry is adopting a wait-and-see attitude before planning any increases in production capacity. Businessmen are uncertain as to how the new coalition government, installed in May 1973, will act to curb inflation. Moreover, Philips has not yet completed the thorough structural reorganization it began in 1971. It is not yet clear, therefore, whether the country's electronics industry will gain or lose as Philips redistributes its production responsibilities among its various European subsidiaries.

Table 1.—Netherlands: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	0.60	0.60	0.70
Printed circuit production equipment	1.40	2.80	3.00
Wiring assembly and other interfacing equipment	3.00	.60	.65
Passive component and miscellaneous production equipment		.60	.70
Test equipment for production/inspection of electronic products		2.40	2.75
Total	5.00	7.00	7.80

Source: Values based on U.S. Department of Commerce, Bureau of International Commerce estimates.

Dutch electronics manufacturers, however, will have to substantially increase investments in automated production and testing methods in order to remain competitive in this period of rising labor costs. Even at Philips, the current level of automation is said to be surprisingly low, despite the fact that wages have been hiked substantially each year for the past several years.

Dutch workers are expected to win further wage increases averaging an estimated 13.5% in 1973, and labor unions are readying new demands for 1974.

The consumer electronics market is expected to grow steadily by 10% per year, thanks to soaring demand for color television and high-fidelity equipment. An estimated 412,000 color receivers were sold in 1973, an increase of 16% over 1972's sales of 354,000 units and of 63% over 1971's total of 252,000 units. Even so, the market is by no means saturated. Only 13% of Dutch households currently own color television sets, and the level of ownership is expected to reach 60% in 1980.

The extent to which the expanding market for television sets and other consumer electronic products will continue to be supplied from domestic production depends on the outcome of policy decisions being made at Philips. It is possible that television production will be shifted entirely to Germany or Belgium and the manufacture of video tape recorders, and eventually of optoelectronic tubes, will be centered in Dutch facilities.

The outlook for domestic components manufacturers is also optimistic. After a 2-year recession characterized by intense competition and declining prices, they began in 1972 to experience a sharp rise in the demand for their products. Many firms, particularly the 20 or so makers of printed circuits, are now purchasing additional EIPT equipment to help fill what has become a considerable backlog of orders.

Demand for industrial electronic products is not expected to be as encouraging as that for consumer goods, due to the general uncertainty with which Dutch businessmen regard the future course of events in the economy. Sales growth is more likely to reflect price increases than rises in unit volume. Producers of scientific instruments and other industrial electronic products are expected to temporarily limit the EIPT equipment investments to replacements.

Competitive Environment

Domestically manufactured EIPT equipment is estimated to have accounted for 25% ($1.1 million) of the production equipment and 20% ($500,000) of the test equipment installed by the Netherlands electronics industry in 1972 (see table 2). Only a small part of this—less than 6% of the total market—was purchased from local EIPT equipment manufacturers; most was manufactured by electronics firms for in-house use.

Philips is the leading manufacturer of EIPT equipment, but most of its production is destined for internal use. Smaller companies affiliated with American electronics firms comprise the remainder of the Netherlands EIPT equipment industry. These include: Sola Basic N.V., which makes cutting equipment; AMP N.V. and Berg Electronics N.V., both of which make wiring equipment; Weld Equipment N.V., which manufactures resistance welding equipment; Tektronix N.V., which produces oscilloscopes; and Ferro N.V., which recently entered the market for specialized furnaces used in the manufacture of electronic components. All these firms export EIPT equipment, mainly to customers in other European countries.

Table 2.—Netherlands: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	0.90	0.35	1.25
by other firms	.25	.15	.40
Imported:			
from the U.S.	2.05	1.55	3.60
from other countries	1.40	.35	1.75
Total	4.60	2.40	7.00

Source: Values based on U.S. Department of Commerce, Bureau of International Commerce estimates.

U.S. is major supplier.—Trade sources estimate that 45% of the production equipment and 65% of the test equipment purchased by the Dutch electronics industry is obtained from American manufacturers. Such imports totaled $3.6 million in 1972 (see table 3). Assuming that the U.S. market share remains at the current level, as is expected, sales should be in excess of $5 million in 1977.

Dutch buyers prefer U.S. EIPT equipment because it is of higher quality and more advanced technologically. Their requirements can be more precisely met by the wider range of highly specialized equipment produced in the United States. Leading U.S. suppliers to the Netherlands include Hewlett-Packard; Teledyne, Inc.; Tektronix, Inc.; Lindberg; AMP Incorporated; the Gardner-Denver Co.; Varian Associates; and the John Fluke Manufacturing Co.

The Netherlands electronics industry obtained approximately $1.7 million worth of EIPT equipment—$1.4 million in production equipment and $350,000 in test equipment—from European and Japanese sources in 1972. Reasons cited by those Dutch users showing preference for European-made equipment include price, compatibility with the metric system, and superior after-sales service.

Table 3.—Netherlands: Imports from the U.S. of electronics industry production and test equipment, estimated 1927 and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	2.0	2.5	2.6
Test equipment	1.6	1.9	2.5
Total	3.6	4.4	5.1

Source: Values based on U.S. Department of Commerce, Bureau of International Commerce estimates and projections.

Customs duties applicable to imports of EIPT equipment from the United States range from 3 to 13%. In addition, both domestic and imported EIPT equipment is subject to a 16% value-added tax. Additional information concerning import duties may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration (Room 4217), Washington, D.C. 20230.

Technical Requirements

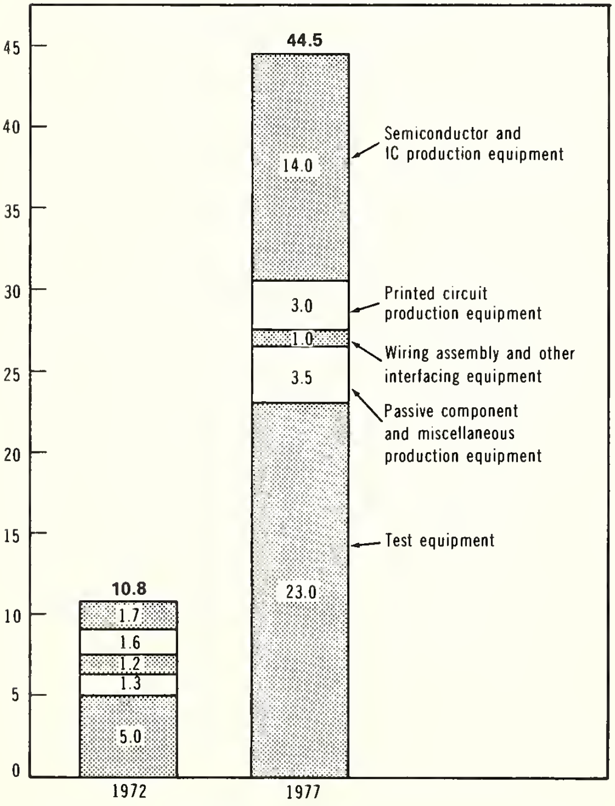
The electrical power supply characteristics in the Netherlands are 220 volts, 50 hertz. The metric system of weights and measures is used exclusively. Further information on the Netherlands' technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

Electronics Industry Production & Test Equipment
Poland

The electronics industry of Poland is given emphasis in the current Five-Year Plan (1970-75) as one of the country's high priority sectors for development.

Poland's electronics industry will be required to reach production levels that would satisfy the surging domestic demand for consumer and industrial electronics products as well as provide a base for significant sales expansion in foreign markets, particularly other East European markets. Expansion of electronics production facilities and modernization of manufacturing techniques thus will proceed at a rapid pace in Poland.

Poland: Consumption of electronics industry production and test equipment, 1972, and projected 1977
(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Polish trade source estimates.

Progress already is evident. Capital investments in electronics industry production and test (EIPT) equipment in Poland tripled from $3.3 million in 1971 to $10 million in 1972 (see table 1). The market again climbed dramatically in 1973, reaching an estimated $36 million.

Trade experts predict that the Polish electronics industry will continue purchasing production and test equipment at this high level at least during the next 4 years. The market in 1977 is projected to to exceed $44 million.

Domestic manufacture of EIPT equipment in Poland is minimal. Poland, therefore, must rely almost entirely on imports. The market now is supplied mostly by EIPT equipment manufacturers from Western nations. Although the United Kingdom, France, and Japan have been the principal suppliers in the past, Polish trade sources expect the bulk of future demand to be met by vastly expanded U.S. exports.

Polish electronics manufacturers favor U.S. equipment, deeming it the most advanced and most reliable on the market. Recent moves to liberalize trade between the United States and Poland are raising the hopes of Polish producers that U.S. equipment soon will be in extensive use on their manufacturing and assembly lines.

Specific Sales Opportunities

The largest and most continuous gains in the Polish EIPT equipment market are expected to occur in sales of testing equipment for production/

Poland—Selected Indicators (1972)

Gross national product:	**$50 billion**
Population:	**32.6 million**
Total country imports:	**$4.6 billion**
Total country exports:	**$4.1 billion**
Exchange rate (official):	**3.32 zlotys = US$1**

inspection of electronics products. Polish purchases in this equipment category rose from a minimal $1 million in 1971 to an estimated $12 million in 1973. The market is forecast to double by 1977, reaching more than $23 million.

Another high potential area for continued sales is seen in the market for semiconductor and integrated circuit production equipment. Purchases, which increased from just under $1 million in 1971 to almost $7 million in 1973, are projected to rise to $14 million in 1977.

Demand for other EIPT equipment—printed circuit production, interfacing, passive component production, and miscellaneous production—apparently reached a peak in 1973, when the market was estimated at $17 million. However, even further gains are foreseen here for U.S. suppliers, as a predicted shift occurs toward replacement of currently installed equipment by more advanced U.S. products.

Recent research conducted by the U.S. Department of Commerce in Poland indicates that the following types of equipment have excellent sales potential:

Semiconductor and Integrated Circuit (IC) Production Equipment

- Substrate preparation equipment
- Ion implantation systems
- Multicathode etching and sputtering systems
- Silicon epitaxial reactors (furnaces)
- Gallium arsenide phosphide reactors (furnaces)
- Infrared heating epitaxial reactors (furnaces)
- Photorepeaters
- Hybrid die bonders
- Flip chip and team lead bonders
- Automatic soldering systems
- Laser scribers
- Plotters
- Screen printers

Printed Circuit Production Equipment

- Artwork and pattern generation equipment
- Component inserting and sequencing machinery
- Protective coating equipment

Wiring Assembly and Other Interfacing Equipment

- Point-to-point wire wrap systems
- Terminal installation machines
- Automatic welding systems
- Card assembly machines

Test Equipment for Production/Inspection of Electronics Products

- Automated (computer controlled) IC test systems for:
    - DC measurements
    - dynamic response measurements
    - functional measurements
- Dynamic test modular systems
- Digital oscilloscopes
- Storage oscilloscopes
- Network analyzers
- Spectrum analyzers
- Film thickness digital monitoring systems
- Printed circuit board testers

The Electronics Industry

The Polish electronics industry is expected to expand production of both consumer and industrial goods as central planners seek to alleviate public pressures to increase the country's living standards. The industry's total output, valued at approximately $1 billion in 1972, is projected to reach $1.7 billion in 1975.

Organization of industry. Polish industrial production is centrally controlled by ministry level planning organizations. Each ministry is in charge of several "combines" or "trusts" which in turn operate the actual production plants.

The two combines responsible for the electronics industry in Poland are UNITRA and MERA; both are under the jurisdiction of the Polish Ministry of of Machine Industry.

UNITRA operates 23 plants with a total work force of 80,000. The combine specializes in the production of consumer goods.

MERA specializes in industrial electronic products and employs 30,000 workers in its 18 plants. MERA's output has been climbing substantially in recent years. Production more than doubled between 1965 and 1970 and exports increased 700% in the same period. Exports are expected to increase by 600% during the current Five-Year Plan.

Table 1.—Poland: Consumption of electronics industry production and test equipment, 1971-73

(in millions of U.S dollars)

	1971	1972	1973
Semiconductor and IC production equipment	0.8	1.7	6.8
Printed circuit production equipment	0.7	1.6	4.0
Wiring assembly and other interfacing equipment	0.4	1.2	5.2
Passive component and miscellaneous production equipment	0.4	1.3	8.0
Test equipment for production/inspection of electronic products	1.0	5.0	12.0
Total	3.3	10.8	360

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Polish trade source estimates.

Production of computers rising.—Poland has been concentrating heavily on developing a viable computer industry. Approximately 860 digital computers are installed in Poland; 50% of the computers were imported.

The domestic computer industry is expanding rapidly, and the value of production in 1975 is expected to exceed $400 million, an increase of 600% over 1970.

A line of third-generation machines known as the "Odra 1325" is being produced by the ELWRO Electronic Works.

In addition, Poland is cooperating with other Council for Mutual Economic Assistance (CMEA) countries in the RIAD computer network project. ELWRO produces the R-30, a third-generation machine designed for use in telecommunications, as a part of the project.

The burgeoning computer industry has spurred Polish production of peripheral equipment. Three plants producing peripherals are the Blonie Precision Mechanics Works, the ERA Works of Measuring Equipment, and the Meramat Works.

The Blonie plant produces paper tape readers and line printers. The line printers can print up to 1,100 lines (128 characters per line) per minute. The Blonie CT-300 reader reads 300 units per second from a 5- or 8-track tape, and the CT-1001 reader can handle 1,000 characters per second from a 5-, 6-, 7- or 8-track tape. The plant also produces a D-102 tape punch which can punch 100 characters per second on a 5-, 6-, 7- or 8-track tape.

The ERA Works produces drum storage equipment, disk memories, and alphanumeric display systems, as well as small computers and desk calculators. Meramat specializes in the production of ferrite magnetic heads, magnetic tape handlers, magnetic tape accessories, and data acquisition equipment.

Production of peripheral equipment is expected to increase twelvefold under the current Five-Year Plan. This increase in production will be absorbed partially by the domestic market but mostly by an expanding export market that is forecast to account for 85% of Polish peripherals sales by 1975.

Production of electronic instruments.—Another sector of the Polish electronics industry undergoing steady growth is electronic measuring instruments. Most plants manufacturing this type of equipment are organized under the MERA combine. Three of the major plants are ELPO United Electronics Measuring Instruments Works, the Zapan Works, and the UNIPAN Pilot Plant of the Polish Academy of Sciences.

ELPO produces wide frequency-range analog voltmeters; resistance, inductance, and capacitance bridges; apparatus for radio and television servicing; gas chromatographs; PH meters; digital voltmeters; and frequency counters which use monolithic IC's of the TTL series. ELPO's type C549-A timer-counter has a capacity of 99,999 pulses, with a frequency range up to 20 MHz. The type C5498 counter produced at ELPO has a frequency range of 50 MHz.

Poland's Electronics Industry—Basic Data (1972)

Total value of production:	**$1 billion**
Number of manufacturers:	**41**
Industry labor force:	**110,000**
Output of selected products:	
Transistors	**14.7 million**
Electron tubes	**29.6 million**
Table radios	**865,000**
Television receivers (B/W)	**665,000**

The Zapan Works specializes in the production of such low-frequency measuring instruments as RC generators, non-linear distortion meters and output power meters, and digital frequency meters. Zapan's 6 decade digital frequency counter type PFL-21 can measure frequencies up to 500 MHz. Their PO-20 RC-generator operates in the frequency range 20kHz to 200 kHz and has a maximum output voltage of 3.16V.

UNIPAN produces microwave devices and low-frequency selective voltmeters for high sensitivity measurements. The 237 selective nanovoltmeter is an example of the type of equipment turned out by UNIPAN. It is intended for the selective measurement of very low alternating voltages in the frequency range 1 Hz to 100 kHz, for spectral analysis of harmonic and noise waveforms, and for use as a high sensitivity null indicator in bridge circuits.

Consumer goods production growing.—Production of consumer goods is being increased by the Polish electronics industry (see table 2). Output is expected to increase 42% over the period 1971-75.

The Zelos television tube factory is doing a booming business in supplying black and white picture tubes to Poland's two television assembly plants at Warsaw and Gdansk. Zelos operates under a licensing agreement with Philips of the Netherlands.

Another plant producing for the consumer market is Fonica, where production of hi-fi equipment is increasing at a rate of 16 to 18% a year. Fonica operates under a licensing agrement with AEG-Telefunken of West Germany.

Electronics Manufacturers' Profiles

The *TEWA Semiconductor Research and Production Plant* employs about 1,500 people in its Warsaw facility. The plant, part of the UNITRA combine, produces *integrated circuits, printed circuit boards, semiconductor devices, thick film potentiometers,* and *semiconductor devices.*

TEWA's production equipment includes artwork and pattern generation equipment, a single-camera step-and-repeat system, an automatic IC tester, diffusion furnaces, and several environmental test stations.

The *Pnefal Industrial Automation Equipment Works* is a member of the MERA combine and specializes in the manufacture of *process control instruments.* The control instruments produced by Pnefal include environmental recorders, peumatic signaling systems, fluidic logic systems, and instrument control panels. Most of the firm's products are considered technically equal to similar Western world products.

The pneumatic control equipment is produced under license from Siemens of West Germany. Pnefal engineers are developing a process control system, centered around the Polish-built "Momik" minicomputer, for use in the petroleum, petrochemical, chemical, and metallurgical industries.

Pnefal has already developed a system using semiconductor logic blocks for signaling process parameters when they exceed preset limits. These systems find particular application in the petrochemical industry.

The *CEMI-ONPMP* plant in Warsaw produces intermetallic semiconductor compounds, solders and special alloys, sintered tungsten for diodes, thyristors, ceramic-to-metal seals, etched shaped products, and ceramic substrate materials for manufacturing thin and thick film devices as well as microwave components.

Silicon and germanium crystal-growing equipment now in use is limited to producing crystals one inch in diameter, and officials are interested in obtaining equipment for larger diameter production.

Imported sputtering and etching equipment now in use includes several machines of the single cathode type. The firm states that there is a demand for multicathode equipment.

PIAP, the *Industrial Institute for Automation and Measurement,* is the main research and development center for the Polish process control industries and is part of the MERA combine. It employs 1,000 engineers, mathematicians, and scientists who concentrate on the development of process control and measurement systems and equipment.

PIAP also designs and tests new automation equipment, conducts research and development on its use in specific areas, and produces prototypes and small lots of instruments designed at the institute.

Instruments and systems developed by the Institute include an electronic analog automation system, including data acquisition and data processing; direct acting pressure and flow controllers: high pressure pneumatic logic elements: remote control systems for ship powerplants; and hydraulic actuators.

The *ELWRO Electronics Works* produces *computers and calculators* in its 5,000-man plant in Wroclaw. Now under production are two third-generation computers, the Odra 1305 and the Odra 1325. The Odra 1305 is a general-purpose processor; the Odra 1325 was designed primarily for process control applications.

The "1325" utilizes 4-layer laminate PC boards, each with an 84-contact terminal strip incorporating approximately 30 integrated circuits placed on a 4-layer laminate board. The working storage of the computer is 16K to 64K, 24-bit words.

ELWRO also is Poland's major participant in the joint EDP equipment production effort of the Council for Mutual Economic Assistance called the RIAD system. The firm's contribution is the R-30 computer, designed for general data processing and scientific and technological calculations, and for use in telecommunications systems.

Electronic calculators produced in the plant include the ELWRO 105L and the ELWRO 205. The 105L is a 12-digit calculator based on LSI circuits and produced according to specifications of Japan's Busicom, while the 205 is of original ELWRO design.

Competitive Environment

Polish demand for EIPT equipment is met almost entirely by imports from Western countries. No breakdown of market share by country is available, but trade sources state that the United Kingdom, France, and Japan are leaders in the market. These countries are experienced in dealing with Poland, and their products are well known.

Several recent developments point to an ever-increasing share of the market for the United States. For example, U.S. equipment has been made more price competitive by the devaluation of the dollar.

Trade between the United States and Poland has been facilitated by two agreements. One agreement provides for a system of reciprocal credits whereby the services of the Export-Import Bank have been made available for transactions with Poland and offers Polish importers of U.S. products access to credit through the Warsaw Trading Bank and the country's various foreign trade enterprises. The other agreement is a procedure which allows U.S. firms to establish sales and services offices in Poland, giving them more direct contact with customers.

In addition, the superior technology of U.S. equipment gives it an edge at a time when Polish officials are emphasizing the need for rapid modernization of production facilities.

Selling in Poland

Foreign trade in Poland is state regulated and is conducted by a network of Foreign Trade Organi-

Table 2.—Poland: Actual and planned output of selected electronics products, 1970, and the Five-Year Plan period, 1971-75

Product	Units	1970	1971	1972	1973	1974	1975
Semiconducting devices	millions	26.5	32.4	37.8	46	55	66
Transistors	"	10.6	12.4	14.7	15	20	28
Electron tubes	"	26.7	28.9	29.6	31	33	36
Radios (table)	thousands	987	893	865	850	950	1,250
Television sets/B&W	"	616	631	665	780	—	900
Television sets/color	"				12	30	60
Tape recorders and dictaphones	"	184	307	417	550	700	750
Telephone sets	"	635	712	788	950	1,200	1,500
Transistor radios	"	448	393	428	500	800	1,000

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Figures based on official Polish sources.

zations (FTO's) under the direction of the Ministry of Foreign Trade and other ministries.

Theoretically, all transactions concerning foreign trade and all contacts with end-users must be handled through the appropriate FTO. In practice, the regulations are being relaxed and foreign firms are finding it possible to make appointments and establish direct contact with Polish end-users without the necessity of repeated recourse to an FTO.

Before a major contract is signed, however, it must be reviewed by the responsible industrial ministry and by the Ministry of Foreign Trade, which also issues a license, which is required for all import/export transactions.

Metronex is the FTO that handles export-import arrangements for MERA. UNITRA serves as its own FTO. These enterprises, along with other FTO's, industrial unions, factories producing for export, banks, and other organizations engaged in foreign trade, are aided in their operations by the Polish Chamber of Foreign Trade.

The Chamber's chief objective is to promote and enhance Poland's economic relations with foreign countries. With this fundamental purpose, the Chamber performs a wide variety of functions, including the formulation and development of contacts between Polish and foreign organizations interested in trade transactions and the collection and publication of information on Polish foreign trade. The Chamber also promotes Polish goods in international markets and arranges Polish participation in trade fairs.

These are just a few of the many services the Chamber provides. Its expertise in the area of foreign trade makes the Chamber a useful channel through which foreign firms may be introduced to the Polish market.

Two methods are available to foreign firms for maintaining regular contact with Polish customers —through specialized Polish agency enterprises or commercial agents, or by establishing an information and servicing branch office in Poland. Both types of operations function on authority granted by the Polish Ministry of Foreign Trade.

Polish agency enterprises, some of which were established before World War II, are joint stock companies which represent foreign firms either on the basis of long-term agreements or on special commission. They provide a spectrum of commercial and technical services, ranging from advertising to the handling of service and warranty matters. They work on a commission basis and employ technical experts and trade specialists to provide contracted service.

Foreign firms may be granted licenses by the Polish Ministry of Foreign Trade to establish their own offices in Poland. Licenses are issued for a period of 1 year and allow the firm to operate an office "to provide technical information and services to maintain stores of spare parts for goods imported by Poland."

Some firms may find both types of representation beneficial in Poland. U.S. firms may also obtain assistance from the U.S. Embassy and the U.S. Department of Commerce Trade Development Center in Warsaw.

The best market possibilities exist for those U.S. firms willing to enter into long-term contracts providing for technology transfers, co-production and joint-marketing to third countries.

Because of a shortage of hard currency, Polish officials are most interested in the purchase of licenses, agreements allowing for counter-purchase of Polish goods, and other cooperative arrangements.

Sales of complete production line capabilities or even complete industrial plants from a single source are considered possibilities in Poland. Companies that can offer advanced technology and sound financing and agree to accept at least 30% of the total value in Polish goods may find this an advantage in obtaining business in Poland.

New-to-market suppliers will find that the length of time required to complete an agreement may vary from 6 to 24 months. Negotiations can be complicated and delicate. Officials of the MERA and UNITRA combines prefer to establish a fairly close relationship with a firm before they are willing to discuss their equipment needs in any detail.

Equipment exhibitions and demonstrations in Poland are particularly useful for developing an atmosphere of mutual sincerity. Establishing close personal relationships with end-users is important in Poland and usually precedes serious business negotiations. The annual Poznan International Fair is an effective forum for displaying products to Polish business officials. The Fair is held in two sessions. The first, in June, deals with industrial products; the second, in September, displays consumer goods. In past years, the Fair has provided facilities for exhibitions and demonstrations as well as for symposia and conferences open to interested participants.

Solo exhibitions also are encouraged and provide excellent opportunities to become acquainted with Polish businessmen.

Polish trade journals are useful media for dispensing company and product information. Firms interested in advertising in these periodicals should contact AGPOL, ul. Sienkiewicza 12, P.O. Box 136, Warsaw, for information and assistance.

Technical Requirements

Poland has an electric supply of 50 cycles, a.c., 220/380 volts. The metric system is used for weights and measures. Information on obtaining technical standards may be requested from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

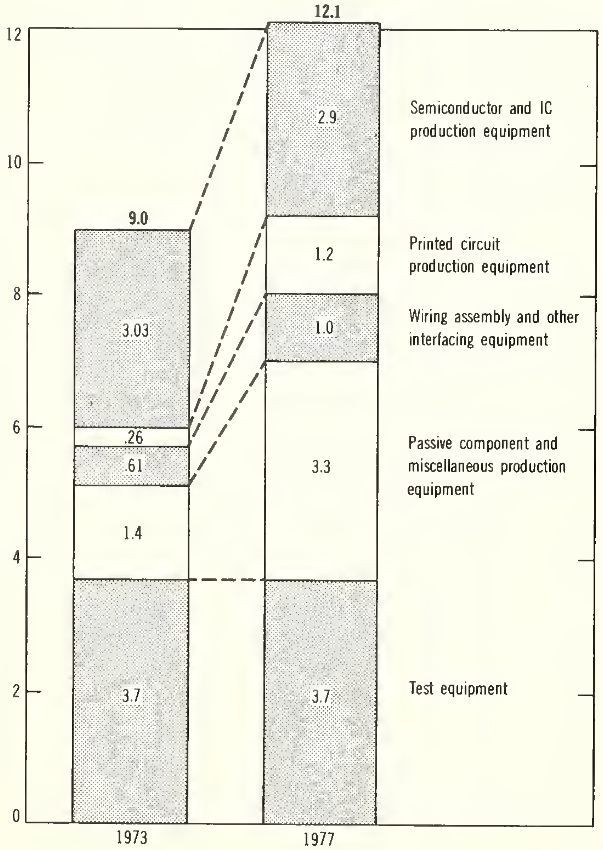
Electronics Industry Production & Test Equipment

Singapore

The vigorous growth of Singapore's electronics industry has been fueled by mounting world needs for electronics components and end products. Keeping pace with export demand has prompted the industry to make sizable investments in production and test equipment. An estimated $6.9 million of such equipment was installed by Singapore's 60 electronics manufacturers in 1972 (see table 1).

The substantial number of new firms entering the industry and the expansion plans announced by established Singapore manufacturers have led market analysts to predict that the country's electronics industry production and test (EIPT) equipment market will exceed $12 million in 1977. This represents an average annual growth rate of 7.6% during the 1973-1977 period.

Singapore: Consumption of electronics industry production and test equipment, 1973, and projected 1977 (in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Singapore trade source estimates.

More widespread use of advanced and automated EIPT equipment can be expected as a result of the shortage of unskilled labor in Singapore, the inevitability of rising labor costs, and the industry's plans to broaden the range of its finished products.

Singapore imported nearly 93% of its EIPT equipment needs in 1972. Imports from American suppliers, valued at $3.35 million, accounted for 48% of the country's total EIPT equipment purchases. Additional equipment, valued at $3.06 million, was obtained from other foreign sources, chiefly Japan, Germany, and the United Kingdom. Only about 8% of Singapore's EIPT market was supplied by domestic firms in 1972. U.S. equipment sales in Singapore are expected to reach $4.3 million in 1977.

Selected Sales Opportunities

A market survey recently conducted in Singapore for the Office of International Marketing, U.S. Department of Commerce, revealed highly favorable export opportunities for U.S. manufacturers of the following products:

Semiconductor and integrated circuit production equipment.—The market for semiconductor and integrated circuit (IC) production equipment in Singapore was estimated at $2.12 million in 1972; this represented an increase of 43% over 1971. Sales are expected to exceed $3 million in 1973

Singapore—Selected Indicators (1972)

Gross national product:	**$2.8 billion**
Population:	**2.1 million**
Total country imports:	**$3.4 billion**
Total country exports:	**$2.2 billion**
Exchange rate (October 1973):	**2.33 Singapore dollars = US$1**

and then decline slightly to $2.9 million by 1977. During this period, the industry will be particularly interested in buying:

- Dicing machines
- Conveyor and diffusion furnaces
- Microscopes
- Bonders
- Soldering equipment and systems
- Leak detectors

Approximately 13 companies in Singapore manufacture semiconductors and integrated circuits, including bipolar and MOS transistors, silicon diodes, hot-carrier diodes, light-emitting diodes, and linear, digital, and hybrid integrated circuits.

Manufacturing consists primarily of assembly operations, starting with the scribing of imported slices of processed silicon wafers. A number of firms, however, plan to move toward fully integrated operations, including the growth of silicon crystals and diffusion of silicon wafers, that will require the purchase of additional equipment.

Some companies plan to expand production. Hewlett-Packard Singapore Pte., Ltd., for example, may spend $300,000 in 1974 on production equipment to increase its output of semiconductors and integrated circuits; this would be more than triple its estimated 1973 purchases of $90,000.

The general demand for semiconductor and integrated circuit production equipment, however, is expected to slacken during the 1974-77 period. Most of Singapore's semiconductor manufacturers have scaled down their expansion plans which were formulated in 1972 and 1973 in expectation of heavy demand. This revision has been prompted by the shortage of workers suited for simple manual operations and the Government's reluctance to grant tax concessions for the expansion or establishment of plant facilities that employ such relatively unskilled labor.

Singapore's semiconductor industry has attracted a high degree of U.S. investment. Many parent firms specify the use of American-made production equipment, particularly bonders and soldering equipment. U.S.-made microscopes are preferred by Singapore users, despite the normally strong position of competing Japanese models.

Printed circuit production equipment.—Singapore's purchases of printed circuit production equipment in 1973 were estimated at $261,000, substantially above the 1972 level of $140,000. Considerable growth in demand is now anticipated, with sales forecast to reach $1.2 million in 1977. Such a rise would represent an average annual growth rate of over 45% during the 1973-1977 period. Market analysts suggest that U.S. exporters will find the best sales opportunities for:

- Cleaning equipment
- Drilling machines
- Electroplating equipment
- Component inserting machines
- Silk screen equipment

The manufacture of printed circuit boards, still in developmental stages in Singapore, is expected to grow rapidly during the 1974-1977 period. Recent increases in export demand for transistor radios and the needs of Singapore's gigantic General Electric plant are responsible for this development. At least three firms—Printed Circuits International, Deltech Electronics Pte., Ltd., and Craftetch Company—are equipping new facilities for printed circuit production.

Multiple-hole drilling machines and silk screen equipment will be required to meet the rising demand for printed circuit boards. In both cases, American-made equipment is preferred for its greater accuracy. American exporters will also find that Singapore's printed circuit board manufacturers, anticipating a manpower shortage and rising labor costs, are interested in purchasing component inserting machines and electroplating equipment.

Wiring assembly and other interfacing equipment.—Singapore's electronics manufacturers spent

Table 1.—Singapore: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	1.48	2.12	3.03
Printed circuit production equipment	.04	.14	.26
Wiring assembly and other interfacing equipment	.25	.41	.61
Passive component and miscellaneous production equipment	1.15	1.35	1.40
Test equipment for production/inspection of electronic products	1.89	2.91	3.70
Total	4.81	6.93	9.00

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Singapore trade source estimates.

an estimated $611,000 for wiring assembly and other interfacing equipment in 1973, an increase of almost 50% over 1972 expenditures of $410,000. Sales are expected to rise at an average annual rate of approximately 13% during the next 4 years, reaching almost $1 million in 1977. Prospects are particularly bright for increased sales by U.S. exporters of:

- Wire-wrap systems
- Crimping machines
- Cutters
- Strippers
- Connector assembly machines

Expansion and diversification of Singapore's output of finished electronics products, notably radios and electronic calculators, is strengthening the demand for wiring assembly and other interfacing equipment. Electronics manufacturers seeking reliable equipment have expressed interest in demonstrations of U.S.-made wire cutters, strippers, and crimping machines. Durability and reliability are also factors in the preference for American-made connector assembly machines.

Passive component and miscellaneous production equipment.—The Singapore market for passive component and miscellaneous production equipment in 1973 was estimated at $1.4 million, slightly above its 1972 level. The outlook for the 1973-77 period indicates that sales should rise by an average annual rate of 24%, exceeding $3.3 million in 1977. The equipment in greatest demand will include:

- Molding presses
- Riveting machines
- Micromaterials handling and positioning equipment
- Metal processing equipment
- Labeling machines
- Metal finishing equipment
- Coil winders

Manufacturers of passive components will need additional production equipment to satisfy rising demand from the industry's rapidly growing finished products sector. The reputation of U.S.-made equipment for reliability, design suitability, and a high degree of precision gives American suppliers an advantage.

U.S. sales are expected to increase, even in the case of molding presses, where German equipment is being actively promoted on the market. Singapore electronics manufacturers find that U.S. exporters offer the widest range of advanced coil winders incorporating laborsaving features and specific designs for individual requirements.

They are also seeking metal forming machines that can withstand the demands of continuous production of chassis and component parts. Furthermore, calculator manufacturers need more riveting machines as they prepare to expand production. All these developments suggest a promising market for American EIPT equipment manufacturers.

Singapore's Electronics Industry—Basic Data (1972)

Total value of production:	**$210 million**
Number of manufacturers (est. 1973):	**60**
Industry labor force (est. 1973):	**24,218**
Output of selected products:	
semiconductors—	**$127 million**
transistor radios—	**$37.9 million**
radio/tape recorder combinations—	**$586,000**

Test equipment for production/inspection of electronic products.—The Singapore electronics industry spent $2.9 million for test equipment in 1972, an increase of 54% over 1971 expenditures. Sales in 1973 are expected to reach $3.7 million. Although this sector of the Singapore EIPT equipment market is not expected to grow appreciably during the 1974-1977 period, there are excellent opportunities for U.S. manufacturers to sell:

- Integrated circuit test equipment
- Transistor test equipment
- Diode test and classifier equipment
- Resistor test equipment
- Printed circuit board test equipment
- Environmental test chambers
- Oscilloscopes

Singapore's electronics manufacturers are acutely aware of the importance of quality control since their products must meet strict international standards. The fact that these specificaions and standards are based on those of the United States has contributed to the industry's continuing pattern of buying about 60% of their test equipment from American suppliers.

Equipment of U.S. manufacture is often uniquely suited for specific procedures, usually permits adjustment to the closest tolerances, and is generally considered to be easier to operate than equipment designed by other foreign suppliers.

A surge in spending for test equipment in the 1970-73 period left the industry well equipped to perform sophisticated testing procedures, including those involving computers. Nevertheless, many firms will need additional equipment, particularly automated systems, as the trend toward automated testing operations continues.

The Electronics Industry

The local electronics industry was originally established to take advantage of low labor costs and favorable Government policies toward foreign-owned enterprises. After a period of sharp expansion, the industry now finds that the supply of unskilled labor has dwindled and that government policies have shifted toward the promotion of more capital-intensive production. The resulting trend toward the manufacture of more sophisticated products using less labor-intensive production methods suggests that Singapore will require more advanced EIPT equipment in the future.

Young industry grows rapidly.—The manufacture of electronic components and end products in Singapore began in 1968, when such internationally known firms as National Semiconductor, Texas Instruments, Inc., Fairchild Camera and Instrument Corporation, and Airco Speer set up production subsidiaries there. Others followed and, by 1973, the industry comprised 60 firms (employing more than 24,000 workers), with a total annual output of $428 million. Table 2 shows the structure of the industry in 1973.

The industry is dominated by foreign firms. U.S.-affiliated companies are estimated to have accounted for 68% of the industry's 1973 output and the bulk of its capital investment, particularly the investment in advanced EIPT equipment.

The largest American firm manufacturing in Singapore is General Electric. Its four major divisions manufacture consumer electronics products, electron tubes, mylar capacitors, integrated circuits, television and audito components, and other items. GE's factroy, which specializes in clock radios, is said to be the world's largest.

Other U.S.-based companies include Hewlett-Packard Singapore Pte., Ltd.; International Technology Pte., Ltd.; Intersil Singapore Pte., Ltd.; Litton Components Pte., Ltd.; Texas Instruments Singapore Pte., Ltd.; Continental Devices Pte., Ltd.; Airco Singapore Pte., Ltd.; and Sperry Rand Singapore Pte., Ltd.

A subsidiary of Philips of the Netherlands, Philips Singapore Pte., Ltd., is the largest of the European firms. Siemens Components Pte., Ltd. (Germany), SGS-ATES Singapore Pte., Ltd. (Italy), and E. Hopt Pte., Ltd. (Germany), are also important manufacturers. Japanese-affiliated electronics firms in Singapore include Nishikawa, Otari Nanpo, Toko Electronics Singapore Pte., Ltd., Sanyo Electronics, and a number of new arrivals including, Hitachi, Ltd., and Matsushita.

Trade estimates of the share of production attributable to the various manufacturers serve as an indication of their relative size. In 1973, four companies—National Semiconductors Pte., Ltd., Hewlett-Packard, Texas Instruments, and Teledyne Semiconductors Pte., Ltd.—produced an estimated 62% of Singapore's $253-million output of integrated circuits, transistors, and diodes. Nine smaller firms were responsible for the remaining 38%.

Singapore's top five manufacturers of consumer electronics products—General Electric Consumer Electronics Pte., Ltd., Philips, Universal Electronics Corporation, Ltd., Roxy Electric Industries Pte., Ltd., and Atlas Electronics Singapore Pte., Ltd.—were responsible for 77% of the country's consumer

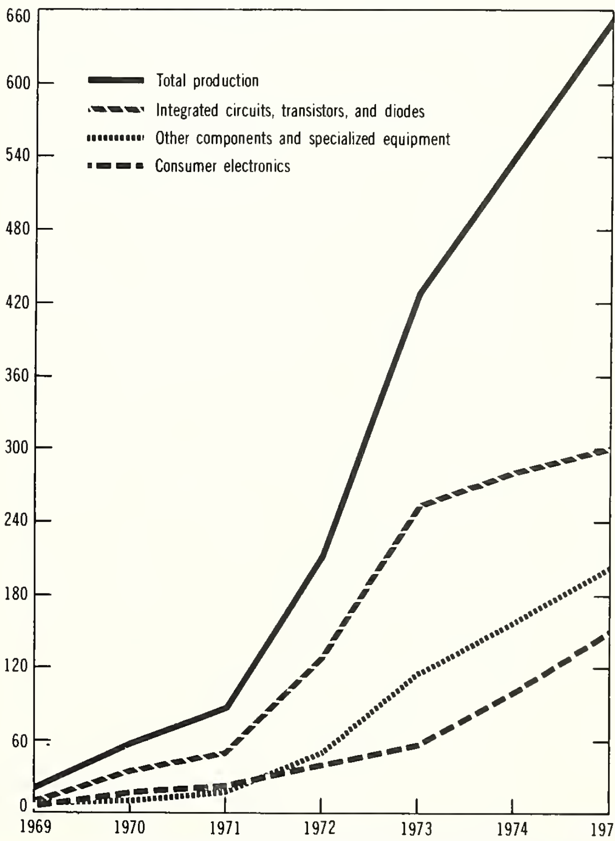
Table 2.—Singapore: Structure of the electronics industry, 1973

Major type of production	No. of firms	No. of workers	Estimated 1973 output (millions of dollars)
Integrated circuits, transistors and diodes	13	6,608	253
Consumer electronics	14	10,100	59
Other components and specialized equipment	33	7,510	116
Total	60	24,218	428

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Singapore trade source estimates.

Singapore: Electronics industry production, by major sectors, 1969-73, and projected 1974-75

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Singapore trade source estimates.

electronics output. The two leaders, Philips and General Electric, together accounted for 44% of the production by this sector of the industry.

Of the 32 firms producing other electronics components and specialized equipment, such as calculators, computer memories, and telecommunications equipment, two—Electronic Memories and Magnetics Pte., Ltd., and General Electric Television and Appliances Pte., Ltd.—were the major manufacturers, with 1973 production shares of 26% and 19% respectively. Four others, Airco, Semicon Electronics Factory Pte., Ltd., Nishikawa, and Otari Nanpo, accounted for 24% of production; the balance was fairly evenly distributed among the 26 other firms.

Employment in the electronics industry rose from 7,500 workers in 1969 to 15,000 workers in 1971 and was estimated to have gone above 24,000 in 1973. Most of the larger firms employ more than 500 workers; five have 1,000 employees.

Manpower is in increasingly short supply in Singapore, which has a population of only 2.1 million. Recognizing that shortages of unskilled workers could become severe, many firms are transferring their labor-intensive operations to nearby Malaysia and Indonesia. A shortage of qualified technical personnel also exists. Although the Singapore Government began to reorganize the country's vocational education curricula at all levels in 1968, the full effects of this program have yet to be felt.

Meanwhile, special programs have been set up to meet the electronics industry's more immediate needs. Approximately 1,500 students now are enrolled in full-time courses in electronics engineering at the Jurong Vocational Institute. Approximately 5,000 highly skilled workers will have graduated from joint government-industry training programs by 1977.

The output of Singapore's electronics industry increased more than twentyfold during the 1969-73 period, going from $21 million to $428 million (see chart on page 4). The bulk of the production consists of electronic components, both active and passive, but primarily semiconductors. Trade sources estimate 1973 output of semiconductors at double that of 1972; i.e., 485 million units valued at $253 million in comparison to 244 million units valued at $127 million.

The passive components sector of the industry includes nine firms manufacturing a total of more than $800,000 worth of capacitors, including paper and plastic film capacitors, polyvaricons, and air dielectric variable capacitors. These firms employed more than 1,000 workers in 1973. Manufacturers of resistors, whose output was valued at $3.5 million in 1973, employ more than 600 workers. Firms making inductors and transformers produced more than $2 million worth of these components in 1973.

Consumer electronics and finished industrial electronics products are assuming greater importance in the industry's total output picture. Production of consumer electronics products jumped from $5 million to an estimated $59 million between 1969 and 1973. On the industrial side, the 1973 output of ferrite core memory planes and stacks; computer circuit board assemblies; and computer parts such as synchros, resolvers, magnetic heads, delay lines, and harness assemblies, was estimated at $12 million. The manufacture of such items as loudspeakers, bonding wires, lead wires, relays, and switches was valued at $3.2 million in 1973.

Table 3.—Singapore: Exports of major electronic products, 1970-71

SITC No.	Item	1970	1971
724203	Transistor radios, medium wave	7.2	18.7
724204	Other transistor radios	6.8	23.0
722213	Electric circuit fittings for radios	5.8	11.3
724109	Miscellaneous parts for television receiving sets	.2	4.7
724209	Miscellaneous parts for radio receiving sets	8.7	13.4
724910	Electric line telephonic and telegraphic apparatus	1.6	3.8
724921	Microphones and amplifiers for radio and public address	2.7	4.9
729303	Crystal valves for radio communication	34.4	21.1
891117	Cassette tape recorders/ players	1.0	5.6

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

Nearly all of Singapore's electronics components and end products are exported. The domestic market is insignificant in size and has practically no influence on manufacturers' production plans. A study made by Singapore's Economic Research Center estimated 1971 electronics product exports at 88% of total production, or $75.9 million. Export figures for major items made in Singapore are shown in table 3, with 1970 and 1971 values in millions of U.S. dollars.

Vertical integration is not common among Singapore's electronics manufacturers, since most firms rely on foreign suppliers for the bulk of their components and parts. However, Airco has fully integrated its production of carbon resistors, from the mixing and blending of raw materials to the final parameter testing of the resistors. Semicon Electronics Factory Pte., Ltd., (a joint venture of U.S., Hong Kong, and Singapore interests) plans to integrate its production of carbon film resistors.

Many transistor radio and television set producers make their own RF, antenna, oscillator, and deflection coils as well as input/output and intermediate frequency transformers. Encouraged by some of the larger manufacturers, a nucleus of independent, specialized component manufacturers capable of supplying the domestic electronics industry is beginning to form. So far, however, the domestic market abosrbs only a fraction of this group's output.

The Singapore Government actively encourages domestic or foreign-owned enterprises, especially export-oriented companies whose manufacturing operations in Singapore would contribute to the further development of the nation's industrial technology. A comprehensive program of tax exemptions has been established. This program benefits not only industries that initially establish themselves in Singapore but also industries that plan to expand existing production facilities.

The type of incentives granted to a firm will depend on the total amount of investment, the degree of technological sophistication involved, the firm's plans for employee training, and the export potential of the products to be manufactured. In addition, the Government has done much to modernize and expand the country's economic infrastructure, setting aside land for industrial parks and improving port and airport facilities, public utilities, and telecommunications services.

Since the Government is particularly interested in promoting the development of a highly advanced electronics industry, it has recently shown some reluctance to grant full tax exemptions for plant facilities that primarily employ unskilled labor, such as semiconductor assembly plants.

Industry attracts foreign manufacturers.—The fortunes of Singapore's electronics industry, and therefore its needs for EIPT equipment, are closely tied to trends in world demand for electronics components and end products. In this regard, leading international electronics manufacturers express confidence in the outlook for export sales of their products and agree that Singapore offers a favorable manufacturing environment.

Perhaps the most significant recent development which could strongly influence the future structure of Singapore's electronics industry is the increase in the number of Japanese electronics firms now studying the possibility of establishing manufacturing subsidiaries in Singapore or planning to expand existing plant facilities there. Hitachi, for example, intends to make its newly established Singapore plant a major production center supplying markets throughout the world. Fujitsu, another Japanese company, has acquired a 5-acre site in the Jurong industrial park for a telecommunications equipment factory.

Between now and 1977, however, the bulk of Singapore's electronics production will continue to be in the hands of companies affiliated with American, European, and domestic producers. Many of these firms have announced plans to increase output and diversify their product lines.

Philips, for example, plans to triple the output of its Singapore factories by 1977, partly by building a new color television plant. The investments of General Electric and Philips in plant and equipment may reach $60 million in total during the 1970's. SGS-ATES Singapore, a leading Italian-owned maker of transistors, diodes, and integrated circuits, foresees increases of 15% annually in the production capacity of its Singapore plants during the 1974-77 period.

These and other expansion plans are expected to raise total Singapore output of electronics components and end-products to $650 million by 1975, or more than 150% of its estimated 1973 level. The consumer electronics sector is likely to experience the greatest growth, as its 1975 production is forecast to reach $150 million, more than 2½ times the 1973 estimate of $59 million.

The industry is expected to manufacture a wider range of passive components, notably resistors and capacitors, and a larger volume of finished industrial electronics products, such as electronic calculators. This could raise production in the area of other components and specialized equipment by 72%, from an estimated $116 million in 1973 to $200 million in 1975.

Although the recent increases in semiconductor output are believed to be leveling off, such production in 1975 is forecast at $300 million, a 19% increase over the estimated $253 million output in 1973.

Singapore's major end-product manufacturers have said that they would like to obtain more of their components from domestic suppliers and fewer from abroad. Accordingly, they are trying to assist local firms in developing their production of such components. Stringent requirements as to price and quality as well as marketing strategies developed by parent companies may, however, dictate a continued dependence on imported components.

Two factors influence the extent to which automation will be applied to electronics manufacture in Singapore. One is the increasing shortage of unskilled labor and the resultant inevitability of a sharp rise in labor costs. The second is the Singapore Government's policy of assisting firms that make use of technologically sophisticated production processes. Although most manufacturers were originally attracted to Singapore by an abundance of low-cost labor, they are likely to be willing to invest more heavily in advanced and automated EIPT equipment as they see such expenditures justified by world market demand for their products.

Component Manufacturers' Profiles

Although there are more than 40 manufacturers of semiconductors and other electronic components in Singapore, six firms each produce more than 10% of total industry output. The firms described below are typical of some of the country's smaller component manufacturers. Siemens was responsible for 4% of Singapore's semiconductor output in 1973, while International Technology and E. Hopt Singapore each accounted for 2% of domestic output of other components and specialized equipment.

Siemens Components Pte., Ltd., a subsidiary of Siemens of Germany, employs 900 workers and manufactures *transistors, integrated circuits, flashtubes,* and *other electronic components;* its output was valued at $8 million in 1973. All of its output is exported. Siemens invested approximately $170,000 in production equipment and $200,000 in test equipment in 1973, nearly all of which was imported. Plans for 1974 indicate that $100,000 will be allocated for semiconductor and integrated circuit production equipment and $80,000 for inspection and test equipment.

International Technology, Ltd., manufactures *coils* and assembles *printed circuit boards.* Its output, all of which is exported, reached approximately $2 million in 1973 and was produced by a labor force of 300. International Technology has invested a total of $320,000 in production equipment and $100,000 in test equipment; annual investments stood at $30,000 and $20,000, respectively, in 1972. The firm reports that 70% of its production equipment and 85% of its test equipment was bought from American suppliers; the remainder was manufactured in-house or obtained from suppliers in Singapore. International Technology's plans for 1973 included expenditures of $50,000 for production equipment and $40,000 for test equipment. Similar levels of spending for EIPT equipment are predicted for 1974. Although this firm presently uses no numerically controlled or computerized equipment, officials anticipate a growing need to replace increasingly scarce and costly manual labor with automated devices.

End-Product Manufacturers' Profiles

The firms described below rank among the largest domestically owned manufacturers of electronics end products in Singapore. Atlas Electronics accounted for 9% of consumer electronics production in 1973; Setron, Ltd., accounted for 7%.

Atlas Electronics Singapore Lte., Ltd., makes *radio receivers* and *tape recorders* as well as some electronics components used in the manufacture of these products, such as *coils, capacitors, transformers,* and *condensors.* It's 1972 output totaled $6 million, all but 1% of which was exported. Atlas employs 1,650 workers. In 1972, this firm spent an estimated $50,000 on production equipment, 80% of which was imported, mainly from Japan. An additional 10% was made in Atlas' own plant, while the remaining 10% was obtained from other Singapore sources. An equal amount was spent on test equipment, 90% of which was imported and 10% made in-house. Atlas' 1973-74 budget allocated approximately $90,000 for production equipment and $60,000 for test equipment. The firm is interested in buying vacuum pumps, automatic flow soldering systems, crimping machines, cutters, strippers, connector assembly machines, molding presses, metal forming machines, labeling machines, metal finishing machines, coil winders, and oscilloscopes.

Setron Limited employs 500 workers and produces approximately $3.5 million annually in *television and radio receivers, tape players,* and *tape recorders.* Most of Setron's output is sold in Singapore; only 30% is exported. Setron spends significant sums for EIPT equipment, having purchased an estimated $210,000 worth of test equipment and $90,000 worth of production equipment in 1972 alone. Indications are that in 1973 and 1974 Setron will spend from $200,000 to $500,000 for test equipment and from $70,000 to $100,000 for wiring assembly and other interfacing equipment. Setron imports two-thirds of its EIPT equipment from the United States and the remainder chiefly from Japan.

The Competitive Environment

There are no Singapore firms that manufacture EIPT equipment exclusively. Several electronics firms do, however, produce small quantities of such equipment for their own use and may occasionally sell some to other Singapore users. Such production accounted for 10% ($400,000) of the production equipment market and 4% ($120,000) of the test equipment market in 1972 (see table 4).

The United States leads all other countries in exports of EIPT equipment to Singapore. About 40%, or $1.6 million, of Singapore's market for production equipment and 60%, or $1.7 million,

Table 4.—Singapore: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972
(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	.24	.06	.30
by other firms	.16	.06	.22
Imported:			
from the U.S.	1.61	1.74	3.35
from other countries	2.01	1.05	3.06
Total	4.02	2.91	6.93

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Singapore trade source estimates.

of the market for test equipment was supplied by American manufacturers in 1972 (see table 5).

This strong showing is attributable not only to the United States' technological lead in the design and manufacture of EIPT equipment but also to the predominance of U.S.-owned companies among Singapore electronics manufacturers. American suppliers of EIPT equipment with representation in Singapore include the John Fluke Manufacturing Co., the General Radio Co., the Heath Co., Hewlett-Packard, Systems Electronics, Inc., and Tektronix, Inc.

Forecasts for 1977 indicate that Singapore end-users are likely to purchase approximately $2.5 million of production equipment and $1.8 million of test equipment from American manufacturers. Although imports of U.S.-made equipment are rising, their predicted 1977 level would represent an overall reduction in the U.S. market share. More intensive competition is expected from Japan, which in the future will play a greater role in Singapore's manufacture of components and consumer electronic products.

More than 10 Japanese companies were among Singapore's leading foreign suppliers of EIPT equipment in 1973. Among these were the Sakata Electronic Industrial Co., Sanwa Radio Measurement Works, Kikushi Electronics, Trio Electronics, Meguro Denpa Sokki, Nikon, and the Japan Engineering Co. Major suppliers from other foreign countries include Rhode & Schwarz, Leitz, and Heraus, of Germany; The Marconi Co., Ltd., Telequipment, and Colchester, of the United Kingdom; and Electrovert, of Canada.

Singapore's electronics manufacturers are seeking more information on American-made EIPT equipment. Many firms express the view that trade shows, on-site demonstrations, and generally improved communications between the American supplier and the potential customer in Singapore would do much to increase U.S. exports of EIPT equipment to this market. Sellers could also take advantage of the fact that important purchasing decisions by U.S.-affiliated companies are frequently made in the home office of the parent firm.

Table 5.—Singapore: Imports from the U.S. of electronics industry production and test equipment, 1972, and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	1.61	2.05	2.50
Test equipment	1.74	1.85	1.85
Total	3.35	3.90	4.35

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Singapore trade source estimates.

Factors that frequently work to the disadvantage of American EIPT equipment suppliers include: delivery time, usually 3 to 4 months from the United States as compared with 2 to 3 months from Japan; the failure of some import representatives to provide satisfactory follow-up service; and a general lack of an adequate local inventory of both new equipment and spare parts. Suppliers who succeed in correcting these deficiencies should greatly increase their sales of EIPT equipment to this promising and dynamic market.

Singapore does not assess customs duties on imported EIPT equipment, nor are there any non-tariff barriers affecting such imports. Additional information concerning import regulations may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Room 5238, Main Commerce Building, Washington, D.C. 20230.

Technical Requirements

Singapore's electric power is supplied at 220 volts, 50 hertz. Although both the English and the metric systems of weights and measures are accepted, the metric system is preferred. Further information on Singapore's technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

The following market research study is available from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M, Main Commerce Building, Washington, D.C. 20230:

"The Market for Electronics Industry Production and Test Equipment in Singapore," DIB 74-01-506, June 1973.

Electronics Industry Production & Test Equipment

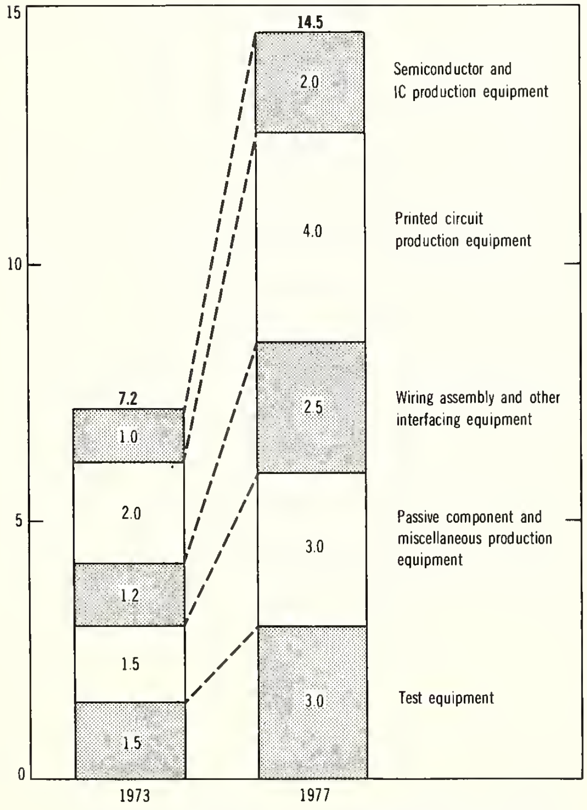
Sweden

Sweden's electronics industry is entering a period of expansion, sparked by strong domestic and international demand for color television sets and by Swedish progress in the development of advanced telecommunications equipment. The country's market for electronics industry production and test (EIPT) equipment is expected to double between 1973 and 1977.

Sales, estimated at more than $7 million in 1973 (see table 1), are expected to grow at an average annual rate of almost 20% during the next 4 years, climbing to over $14 million in 1977.

Sweden: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Swedish trade source estimates.

An estimated 19% or $1.1 million of the EIPT equipment purchased by Sweden in 1972 was of U.S. origin, while an additional 34%, or almost $2 million, was from other foreign suppliers. Local end-users of EIPT equipment produced in-house 40% of their production and test equipment needs in 1972 and purchased another 7% from other Swedish firms.

Despite competition from leading European EIPT equipment makers and increasingly active promotional efforts by Far Eastern manufacturers, American suppliers should be assured of a stable future level of participation in the Swedish market because of their outstanding reputation for quality products with advanced design.

Selected Sales Opportunities

A market research study recently conducted in Sweden for the Office of International Marketing, U.S. Department of Commerce, indicates a favorable sales outlook for a wide range of U.S.-made EIPT equipment as the Swedish electronics industry recovers from the effects of the 1970-72 period of economic stagnation.

Swedish purchases of semiconductor and integrated circuit production equipment, which totaled $800,000 in 1972 and were estimated at $1 million in 1973, are expected to increase at an average annual rate of nearly 19%, reaching the $2-million level in 1977.

Printed circuit production equipment is currently the most important product subcategory of the Swedish EIPT equipment market in terms of sales

Sweden—Selected Indicators (1972)

Gross national product:	**$41.9 billion**
Population:	**8.2 million**
Total country imports:	**$8.1 billion**
Total country exports:	**$8.7 billion**
Exchange rate (October 1973):	**4.13 Kroner = US$1**

volume. Annual sales should rise to at least $4 million by 1977, doubling the projected 1973 level of $2 million.

Swedish customers spent approximately $1 million in 1972 and $1.2 million in 1973 for wiring assembly and other interfacing equipment. Such expenditures should reach $2.5 million in 1977. Purchases of passive component and miscellaneous production equipment, estimated at $1.5 million in both 1972 and 1973, are expected to double by 1977.

Sales of test equipment used in production/inspection of electronics products are expected to increase from an estimated $1.5 million in 1973 to $3 million in 1977.

Swedish trade sources have identified the following EIPT equipment as providing good-to-excellent export opportunities for American manufacturers:

Semiconductor and Integrated Circuit Production Equipment

- Masking and step-and-repeat cameras
- Expitaxial growth equipment
- Furnaces
- Ion implantation equipment
- Microscopes
- Photoresist stripping machines
- Vacuum pumps
- Screen printers
- Scribing machines
- Bonders
- Soldering equipment
- Sputtering equipment
- Wafer sorters
- Leak detectors
- Film resistor trimmers

Printed Circuit Production Equipment

- PC cameras
- Cleaning and drying equipment
- Photoprinters
- Etching machines
- Drilling machines (high resolution)
- Photoresist systems
- Silkscreen equipment

Wiring Assembly and Other Interfacing Equipment

- Wire-wrap systems
- Welding systems
- Color-coding systems
- Cutters
- Measuring machines
- Strippers
- Terminal-installing machines
- Cable harness equipment
- Connector assembly machines
- Card assembly machines

Passive Component and Miscellaneous Production Equipment

- Micromaterials handling and positioning equipment
- Metal-forming machines
- Labeling machines
- Embossing machines
- Coil winders

Test Equipment for Production/Inspection of Electronics Products

- Integrated circuit test equipment
- Transistor test equipment
- Diode test equipment
- Printed circuit board testers
- Digital systems analyzers
- Wafer probing equipment
- X-ray inspection equipment

American EIPT equipment exporters will find the Swedish electronics industry interested in purchasing test and inspection equipment, wiring assembly and interfacing equipment, and general calibration equipment. However, since the industry generally makes limited quantities of each production series and changes its product lines frequently, many firms may be reluctant to invest in production equipment for use only in highly specialized applications.

Swedish purchasers are showing a greater interest in computer-controlled machine tools, automated testing apparatus, and other sophisticated EIPT equipment. They recognize that Sweden's labor costs, already among the world's highest, probably will continue to rise, adversely affecting the competitive position of Swedish-manufactured goods in export markets.

The Electronics Industry

Sweden's electronics industry enjoys a reputation for manufacturing high-quality products made according to exacting technical standards and for in-

Table 1.—Sweden: Consumption of electronics industry production and test equipment, 1972-73
(in millions of U.S. dollars)

	1972	1973
Semiconductor and integrated circuit production equipment	0.8	1.0
Printed circuit production equipment..	1.5	2.0
Wiring assembly and other interfacing equipment	1.0	1.2
Passive component and miscellaneous production equipment	1.5	1.5
Test equipment for production/inspection of electronics products	1.0	1.5
Total	5.8	7.2

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Swedish trade source estimates.

corporating unique features in the design of its products, particularly its telecommunications devices, medical electronics apparatus, and measuring and control systems. Some Swedish-owned electronics firms, notably AGA AB and Telefon AB L. M. Ericsson, rank among the world's leaders in their fields.

Industry product range extensive.—The electronics industry in Sweden includes approximately 20 manufacturers with annual production ranging from $400,000 to over $300 million. The industry's total 1972 output was estimated at $912 million, a level that included a substantial amount of telecommunications equipment. Sales by firms engaged primarily in the manufacture of telecommunications equipment were estimated at $394 million in 1972.

Table 2.—Sweden: Production of selected electronic components and end-products, 1969, estimated 1972, and projected 1975

(in millions of U.S. dollars)

	1969	1972	1975
Semiconductors	1.9	6.1	8.5
Tubes	.8	1.0	1.5
Photocells, piezo-crystals	.1	.2	.3
RTV transformers	1.5	2.1	2.5
Measuring transformers	2.8	4.3	5.0
Inductors	4.0	2.8	3.5
Parts for inductors and transformers	5.3	6.0	7.5
Capacitors	9.2	13.6	16.0
Resistors	1.3	1.9	2.5
Relays, max. 60 V	.5	.8	1.4
Rectifiers, dry metal	16.0	23.0	26.0
Other static converters	4.3	6.4	8.0
Radio subassemblies	9.6	11.7	17.4
Radios	8.3	6.0	7.0
Color television sets	24.9	60.0	80.0
B/W television sets	8.7	5.0	7.0
Parts for radios and television sets	3.6	6.5	12.0
Radio communications equipment:			
R/T transmitters	4.5	8.6	11.0
R/T receivers	2.5	2.5	3.0
R/T relay equipment	.1	—	—
Radar	34.7	24.0	30.0
Misc. radio navigational equipment	14.3	24.0	33.0
Television cameras and transmitters	1.6	2.1	3.0
Industrial TV transmitters	.3	2.5	3.5
Computers and related equipment	39.0	73.0	85.0
Parts for electronic calculators	6.7	9.0	15.0
Medical diagnostic instruments	6.8	14.0	20.0
X-ray equipment	7.5	9.0	12.0
Microwave ovens	1.4	2.6	4.0
Induction and dielectric heaters	1.9	4.0	5.9
Traffic control and signaling equipment	5.9	7.8	10.5
Telephone handsets	29.2	36.5	43.0
Telephone exchanges	157.0	180.0	220.0
Carrier line systems	18.4	26.5	31.0
Parts for telephone systems	25.0	50.0	65.0
Total, selected items	459.6	633.5	801.0

Source: U.S. Department of Commerce, Bureau of International Commerce market research study.

Sweden's Electronics Industry—Basic Data (1972)

Total value of production:	**$912 million**
Number of manufacturers:	**20**
Industry labor force:	**100,000 (approx.)**
Output of selected products:	
Telephone equipment—	**$293 million**
Consumer radios and television receivers—	**$77.5 million**
Radar and other navigational equipment—	**$48 million**
Medical diagnostic instruments—	**$14 million**

Sales of companies specializing in entertainment electronics amounted to $120 million, half of which consisted of color television sets. Sweden also produced $73-million worth of computers and related equipment, $48 million of radar and other navigational equipment, and $14 million of medical diagnostic equipment in 1972 (see table 2). Swedish production of semiconductors in that year was estimated at $6.1 million.

Manufacturing subsidiaries of foreign corporations accounted for slightly more than $200 million of Sweden's 1972 electronics production. Standard Radio and Telefon AB, a subsidiary of the U.S.-based ITT Corporation, and StanSaab Elektronik AB, a joint venture of three Swedish firms including Standard Radio and Telefon, together produced $48 million worth of electronics equipment. The three Swedish subsidiaries of Philips of the Netherlands reported output of $72 million. Siemens-Elema AB, a subsidiary of Siemens of Germany, and IBM Svenska AB, a subsidiary of the IBM Corporation of the United States, manufactured an estimated $30 million and $59 million, respectively, in electronics equipment in 1972.

Employment in Sweden's electronics industry has been placed at approximately 100,000. The small but highly respected manufacturing and consulting firm of Adelta AB has a staff of only 12 persons; by contrast, the giant Allmanna Svenska Elektriska AB (ASEA) employs 18,800 in the parent firm alone; and L. M. Ericsson has 27,400 on its domestic payroll.

The labor shortages characteristic of the 1960's came to an end late in the decade with an influx of workers from Finland and the Mediterranean countries. High unemployment rates began developing during the 1970-72 recession, and the jobless rate in 1973 was still high by Swedish standards. Labor costs did not decrease, however, and shortages, particularly of skilled labor, still persist in many fields.

The Swedish Government has played only a modest role in the development of the country's electronics industry. Research centers at the State Universities and the three Royal Institutes of Technology (in Stockholm, Lund, and Linkoping) conduct government-supported basic research in electronics. These institutions supplement their income by performing studies for both Swedish and foreign private enterprises.

Other institutions involved in electronics research include the Institute of Semiconductor Research (HAFO); the Chalmers University Institute of Technology (Goteborg), which collaborates with Case Western Reserve University (Cleveland, Ohio); the Research Institute of National Defense (Stockholm); the Institute of Physics at the University of Uppsala; and the Electronic Service of the Swedish Natural Sciences Research Council (Uppsala).

Industry entering growth period.—Rising domestic and world market demand for color television sets, advanced telecommunications equipment and systems, and computer-related equipment provide the impetus for the electronics industry's expansion of production during the 1973-77 period.

Forecasts of the 1975 output for selected electronic components and end products point to a nearly 37% increase in the manufacture of entertainment equipment over its estimated 1972 level, a 30% jump in radio communications equipment production, a rise of 22% in telecommunications, a gain of 21% in electronic component production, and a 16% rise in the output of computers and related equipment.

Because of the excess capacity that resulted from the effects of the 1970-72 recession, most firms in the electronics industry should be able to achieve moderate increases in production without enlarging their plant facilities. However, greater investments in modern EIPT equipment will be made as companies feel the pressure of rising labor costs on their profit margins and on their competitive position in export markets.

Siemens-Elema AB plans to automate and computerize the rigorous testing of components, a process that now creates a bottleneck in the firm's production of advanced biomedical equipment. L. M. Ericsson is also considering the acquisition of automated component testing equipment and of automatic assembly and drilling machinery. Svenska Radio AB, an Ericsson subsidiary, is seeking automated bonding machines and related feed devices.

Equipment that operators can use with the aid of simple instruction manuals is attractive to the growing number of manufacturers concerned with the problems and costs of employee training.

Component Manufacturers' Profiles

The production of electronic components in Sweden is still in the early stages of development. Two of the three components manufacturers described below are research institutes that have found themselves increasingly involved in production while continuing to conduct wide-ranging research and development activities in electronics.

AB Rifa, a subsidiary of Telefon AB L.M. Ericsson, manufactured approximately $24 million worth of *semiconductors, capacitors, integrated circuits*, and other electronic components in 1972. This firm employs 1,600 workers, of which 100 are assigned to the semiconducter division. Although Rifa has built much of its own production equipment and makes nearly all of its measuring devices, management is now considering the purchase of EIPT equipment, particularly the automatic equipment needed for the production of tantalum capacitors.

Rifa is also interested in purchasing high-speed die bonders for hybrids; autuomatic bonding equipment with automatic feeding capability; thick film bit soldering units; wire bonders; various types of welding equipment, including cold and ultrasonic; apparatus for mounting windings in forms; tape equipment for outer insulation of casings; testing machinery; vacuum pumps; equipment for setting up and dosing epoxy resins; ohm-farad meters with reliable tension reference; and insulation measuring meters.

The *Institute of Semiconductor Research (HAFO)*, an associate of Allmanna Svenska Elektriska (ASEA), manufactures limited quantities of *semiconductors*, including *thermistors, silicon resistances, light diodes, double diodes for telephone exchanges*, and *MOS circuits*, in conjunction with its research and development work. Highly respected for its technical competence and sophistication, HAFO also performs tests for ASEA and for Microwave Department of the Royal Institute of Technology (KTH Microwave). Despite its limited output, HAFO has invested heavily in EIPT equipment, including a helium leak detector, evaporation and sputtering equipment, a step-and-repeat camera, diffusion furnaces, crystal growing equipment, and computerized construction aids. Future requirements, influenced by planned concentration on MOS circuitry, include ion implantation equipment, accessory equipment for MOS-LSI, semiconductor test equipment, automatic silicon wafer handling equipment, and wire bonding equipment.

The *Royal Institute of Technology, Microwave Department (KTH Microwave)*, plans to increase its production of *diodes, varactors, Gunn-diodes*, and custom-made *oscillators* and to assume some of the testing functions now performed for them by HAFO. In line with these plans, KTH Microwave anticipates spending $250,000 on production equipment and $10,000 on test equipment during the next several years. The telecommunications industry and the Swedish armed forces are KTH's principal customers.

End-Product Manufacturers' Profiles

AB Luxor, Sweden's principal manufacturer of *television and stereo equipment,* is growing more rapidly than any other firm in the electronics industry. Luxor increased its production capacity by 75% between 1970 and 1973. It's principal competitor is Norrkopings Elektrotekniska Fabriker (NEFA), a subsidiary of Philips of the Netherlands. As a result of Sweden's soaring demand for color television receivers, Luxor's sales rose from approximately $32 million in 1969 to more than $60 million in 1971.

Color television accounted for $47.6 million of the 1971 sales, black and white television sets for $4.4 million, and stereo equipment for $8.8 million. Luxor's 1971 exports of color television sets totaled $13 million. The firm expected to realize about $14 million in 1973 from the sale of 30,000 color sets to the United Kingdom alone.

Luxor buys components from outside suppliers and assembles them according to its own designs. All subassemblies are tested on receipt, and components are spot-checked. EIPT equipment that might be of interest to Luxor include apparatus to test TV picture tubes, automatic testing equipment for circuit boards, and automatic assembly equipment. Other specialized test or calibration equipment is built in-house.

StanSaab Elektronik, AB, Sweden's leading manufacturer of *special-purpose computers, computer terminals,* and *peripherals,* is owned jointly by Saab-Scania (the country's only manufacturer of general-purpose computers), Standard Radio & Telefon AB (a subsidiary of ITT), and Svenska Utvecklings AB (a government corporation). StanSaab, together with Telefon AB L.M. Ericsson, ASEA, and Facit AB, is at the forefront of Sweden's growing computer-related equipment industry.

StanSaab makes considerable use of integrated systems and has a comprehensive computer-controlled system for its production and testing procedures. The firm spends approximately $270,000 annually on EIPT equipment, most of which is manufactured in-house. StanSaab has expressed interest in purchasing circuit board positioning equipment, automatic wire-riveting machines, automatic component insertion machinery, devices for punching contact points, component preparation machinery, computer-controlled test systems, and simple inspection equipment.

AGA AB makes *signaling systems, navigational aids, biomedical equipment, electro-optical instruments,* and *welding equipment.* One of its Swedish subsidiaries manufactures *batteries, rectifiers,* and *other electronics components.* Founded in 1904, AGA enjoys an excellent international reputation for quality products and has established subsidiaries in 30 countries.

Production value for the AGA corporate group was estimated at $240 million in 1972; of this, the parent firm accounted for $60 million. Its output of electronics products, including medical equipment, was estimated at $37 million for the same year. The signaling and navigational equipment division alone makes 4,000 radio communications units annually.

AGA would like to automate some of its manufacturing operations and computerize the generation of aspherical surfaces on lenses. AGA is also interested in a computerized system, perhaps one using BASIC, to test radio communications equipment. The firm has purchased an automatic soldering system and needs equipment for washing IC boards. Cable-marking equipment is also of interest.

Competitive Environment

Sweden's manufacture of EIPT equipment is essentially limited to in-house production by end-users. Such production was estimated at $2.3 million in 1972, more than $2.1 of which consisted of production equipment (see table 3). Local production of EIPT equipment for sale in the Swedish market accounted for less than $500,000. About 20% of this total consisted of test equipment.

U.S. sales of EIPT equipment to Sweden in 1972 filled 17.5% of the country's requirements for production equipment and 25% of its needs for testing apparatus, as total EIPT equipment shipments from U.S. firms approached $1.1 million (see table 4). American suppliers can expect to maintain or better their present position in the market as the Swedish electronics industry turns to more automated methods of production and testing.

Other countries sold nearly $2 million worth of EIPT equipment to Sweden in 1972. The greatest part of this—$1.4 million—consisted of production equipment; about $550,000 was in sales of test equipment. Foreign EIPT equipment suppliers active in the Swedish market include: Siemens, Rohde &

Table 3.—Sweden: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	2.16	0.13	2.29
by other firms	.36	.08	.44
Imported:			
from the U.S.	.84	.25	1.09
from other countries..	1.44	.55	1.99
Total	4.80	1.01	5.81

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Swedish trade source estimates.

Table 4.—Sweden: Imports from the United States of electronics industry production and test equipment 1972 and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	0.84	1.21	2.01
Test equipment	.25	.45	.75
Total	1.09	1.66	2.76

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on Swedish trade source estimates.

Schway, Mehawatt, and Hartmann Braun of Germany; Philips of the Netherlands; Marconi, Cambridge, and Taylor of the United Kingdom; and Radiometer of Denmark. Trade sources also report increased activity by Japanese suppliers.

Customs duties applicable to the product category range from 5 to 8%. There are no other restrictions on imports of EIPT equipment into Sweden. Additional information concerning import duties and regulations may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Room 4219 Main Commerce Building, Washington, D.C. 20230.

Technical Requirements

Sweden's electrical power supply is 220 volts, 50 hertz, 3-phase. Where required, 380-volt, 50 hertz installations can be obtained. Electrical equipment imported into Sweden must be tested and approved by Svenska Elektrika Materielkontrollanstalten (SEMKO), which is located at Franzengatan 5, Box 30 049, S-104 25 Stockholm 30. Sweden uses the metric system of weights and measures. Additional information on Sweden's technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

The following market research survey is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M Main Commerce Biulding, Washington, D.C. 20230:

"The Market for Electronics Industry Production and Test Equipment in Sweden," DIB 74-01-500, June 1973.

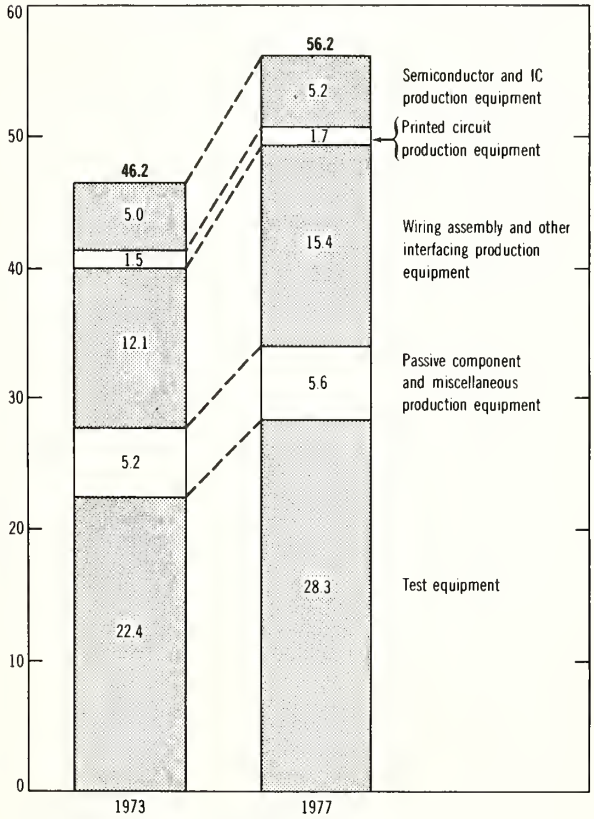
Electronics Industry Production & Test Equipment
United Kingdom

A strong recovery in Britain's electronics industry is stimulating substantial investments in production and test equipment. Trade sources estimate 1973 consumption at more than $46 million, a 20%-plus increase over the 1972 market of $38.13 million (see table 1).

The British electronics industry production and test (EIPT) equipment market should top $56 million by 1977, reflecting steady plant expansion and replacement of existing capital equipment. Projections for the British electronics industry show demand for consumer electronics, headed by booming color television sales, rising at an average annual rate as high as 25%. Increasing sales of defense and industrial capital electronics goods also point toward a continuing growth potential for the British EIPT equipment market.

United Kingdom: Consumption of electronics industry production and test equipment, 1973, and projected 1977

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on U.K. trade source estimates.

American manufacturers presently supply about 20% of this important market. Imports from the United States are expected to keep pace with the overall growth of the market and by 1977 should exceed $10 million, up substantially from the $7.8 million level in 1972.

Local sources supplied close to two-thirds of the 1972 British EIPT equipment market (see table 2). About 33% of total consumption consisted of equipment that electronics companies designed and fabricated solely for their own use. An additional 31% of the 1972 market, or $11.8 million worth, was manufactured by commercial suppliers in the United Kingdom. Foreign firms other than American held about a 16% share of the market.

Selected Sales Opportunities

A market survey of the electronics industry recently conducted in the United Kingdom for the Office of International Marketing, U.S. Department of Commerce, reveals a broad range of growth sales opportunities for American manufacturers of production and test equipment.

Semiconductor and integrated circuit production equipment.—The British market for semiconductor and integrated circuit (IC) production equipment is expected to top $5.2 million in 1977, more than double the 1971 market of $2.47 million. Current consumption is estimated at almost $5 million.

United Kingdom—Selected Indicators (1972)

Gross national product:	**$130.4 billion**
Population:	**55,711,000**
Total country imports:	**$33 billion**
Total country exports:	**$33.5 billion**
Exchange rate (October 1973):	**0.41 pounds =US$1**

American manufacturers, who presently supply about 90% of this subcategory of the EIPT equipment market, should find promising sales potential for the following products:

- Masking and step-and-repeat cameras
- Crystal growing equipment
- Furnaces
- Scribing machines
- Mask alignment machines
- Wire bonding machines
- Plastic molding presses
- Laser thick/thin film resistor trimmers

New applications for integrated circuits in entertainment electronics, telecommunications, radar, instrumentation, controls, and computers have increased demand for IC production equipment. British semiconductor manufacturers have been reaping the benefits of soaring color television sales. As a result, equipment to produce semiconductors is also in demand, and American exporters are in an excellent position to capitalize on this expanding market.

Such U.S.-made products as masking and step-and-repeat cameras, crystal growing equipment, mask alignment machines, and wire bonding machines are not yet produced on any significant scale in Western Europe, and British industries will continue to purchase American equipment to fill most of their requirements. In addition, there are only a few European suppliers of furnaces, scribing machines, and most other types of semiconductor and IC production equipment. U.S. suppliers with competitive prices are expected to find increasing sales in these markets. American producers also hold a firm position in Britain's expanding laser resistor trimming market and claim over 50% of the market for plastic molding presses despite keen competition from British and German manufacturers.

Printed circuit production equipment.—The British market for printed circuit production equipment, estimated at $1.46 million in 1973, should reach nearly $1.7 million in 1977. The modest scale of production of printed circuits in the United Kingdom has inhibited domestic manufacture of production equipment, forcing British end-users to turn to foreign suppliers to meet their equipment needs. American exporters lead in this field, supplying almost 85% of the country's market. The following types of equipment offer high sales potential for U.S. manufacturers: Photoprinters; drilling machines; and silk screen equipment.

U.S.-made drilling machines, although generally higher priced, have a performance record considered markedly superior to European models and are preferred by British manufacturers of printed circuit boards. Similarly, American printing equipment manufacturers have gained a clear-cut competitive edge over European makers in the local market.

American producers face greater competition from British and European suppliers in the market for smaller, less sophisticated types of printed circuit board production equipment, such as plating baths, cleaning and drying equipment, profilers, and component inserting machines.

Many printed circuit manufacturers in Britain are committed to a policy of automation; thus, although production rates may be lower than in the United States, the demand for sophisticated equipment is expected to rise.

Wiring assembly and other interfacing equipment.—The British market for wiring assembly and other interfacing equipment is estimated at over $12 million. Consumption in 1977 should reach $15.4 million, almost 50% higher than the $10.45 million market of 1971. U.S. manufacturers presently hold about a 30% share of Britain's wiring assembly and other interfacing equipment market and can anticipate increased sales during the next few years, especially in the following product lines:

- Automatic reflow soldering systems
- Crimping machines
- Cutters
- Strippers
- Terminal-installing machines
- Connector assembly machines

Table 1.—United Kingdom: Consumption of electronics industry production and test equipment, 1971-73
(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	2.47	2.75	4.95
Printed circuit production equipment	1.01	1.13	1.46
Wiring assembly and other interfacing equipment	10.45	11.00	12.10
Passive component and miscellaneous production equipment	3.37	3.75	5.25
Test equipment for production/inspection of electronic products	17.94	19.50	22.42
Total	35.24	38.13	46.18

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on U.K. trade source estimates.

American suppliers are particularly active in marketing assembly equipment to the electronics industry. U.S. exporters supply 50% of this $3-million market and should remain strong competitors for the foreseeable future. The market for small hand tools also presents an area of high sales potential for U.S. suppliers. Although cutters, strippers, pliers, and soldering irons are available from domestic manufacturers, demand is strong for foreign equipment that offers unique features.

One U.S. exporter, for example, captured approximately 60% of the British market for soldering irons by introducing a high-quality thermostatically controlled model. Although this model was more expensive than conventional irons, the advantages incurred in its use made it popular with British buyers.

In all, end-users manufacture about 70% of the equipment used in wiring assembly and interfacing parts and accessories. High sales potential exists, however, for U.S. suppliers of such products as point-to-point wiring and cable harness assembly equipment, provided they can design or adapt their equipment to meet the requirements of local manufacturers. A developing market also exists for automatic reflow soldering equipment.

Passive component and miscellaneous production equipment.—Britain's market for passive component production equipment increased 55% between 1971 and 1973, going from $3.37 million to an estimated $5.25 million. Growth during the 1974-77 period should be moderate, with expectations of a $5.6-million market in 1977. U.S. suppliers, now holding about 30% of this market, can anticipate future sales of such products as coil winders and capacitor winders.

Current annual sales of winding machinery for coils and capacitors are valued at $2.25 million. End-users are receptive to new types of winders, both the simple, inexpensive type for short runs and high-performance equipment for producing more complex components. American winding machine manufacturers offering quality and innovative designs should be able to capture a substantial share of the market.

Test equipment for production/inspection of electronic products.—A 6% average annual growth rate during the 1974-77 period is predicted for the electronics industry's test equipment market, which should top $28 million in 1977. Demand for test equipment has grown appreciably in the last few years; the market increased 25% between 1971 and 1973, climbing from $17.9 million to an estimated $22.4 million. A wide range of products offer excellent sales opportunities for American manufacturers of test equipment:

- Test equipment for incoming inspection of integrated circuits and other semiconductor devices
- Chip evaluation equipment
- Wafer probing equipment
- Wire bond testers

The U.K. Electronics Industry—Basic Data (1971)

Total value of production:	**$3.2 billion**
Number of manufacturers:	**Over 300 medium-to-large firms**
Industry labor force:	**402,390**
Output of selected products:	
Television sets (est. 1972)—	**$594 million**
Computers—	**$463 million**
Radar and navigational aids—	**$269 million**
Industrial control equipment—	**$203 million**

U.S. manufacturers currently supply over 90% of the British market for automatic and semiautomatic semiconductor and IC testers and should retain their competive lead through 1977. Strong demand for inspection instruments for integrated circuits can be found among computer manufacturers. American wafer probing equipment, wire bond testers, and chip evaluation equipment are also preferred in Britain, with over 80% of these markets currently supplied by the United States.

American producers of equipment for testing completed electronic products, including oscilloscopes, signal generators, digital voltmeters, and counter timers, will find good sales opportunities for their products in the United Kingdom. U.S. firms and their British subsidiaries currently supply over 50% of this $10-million market.

American manufacturers of capacitor and relay test equipment also will find a receptive market in the United Kingdom. Some 70% of capacitor and relay test equipment is now fabricated in-house, but competitively priced commercial products are acceptable.

The Electronics Industry

The United Kingdom's electronics industry currently includes over 300 firms whose annual sales exceed $1.2 million each. The gross output of the industry in 1971 was valued at $3.7 billion, or almost double the 1966 sales of $1.9 billion. Allowing for the value of components subsequently incorporated in British-produced equipment, the industry's 1971 output was estimated to be $3.2 billion. The domestic industry is most competitive in telecommunications equipment, passive components, and industrial electronic equipment.

Vertical integration limited.—Britain's eight largest electronics companies, each with yearly sales exceeding $300 million, are: the General Electric Company (GEC), Thorn Electrical Industries, the Plessey Company, Philips Electronic and Associated Industries, IBM United Kingdom Holdings, the Rank Organisation, Standard Telephones and Cables (STC), and International Computers Limited (ICL).

Three of these firms, STC, Philips, and Plessey, evidence a high degree of vertical integration; i.e., they produce a large percentage of components used in their manufacturing. GEC and Thorn produce a smaller percentage of the components they use.

STC, a subsidiary of International Telephone and Telegraph (ITT), is one of the major British suppliers of telecommunications equipment. The company's component manufacturing subsidiaries are ITT Semiconductors and ITT Components Group Europe, which manufacture relays, rectifiers, quartz crystals, capacitors, and valves. These subsidiaries generally supply STC, although the parent firm is under no obligation to buy from them.

Plessey's activities are primarily in telecommunications, electronic equipment, and components. About 22% of Plessey's turnover of $680 million in FY 1972 was derived from sales of a wide variety of components.

Philips is a subsidiary of the Dutch electronics firm, NV Philips Gloeilampenfabrieken, and has four component manufacturing subsidiaries in the United Kingdom: Mullard, Ltd.; Pye Telecommunications, Ltd.; Magnetic Devices, Ltd.; and Newmarket Transistors. Mullard produces electronic components and is the second largest British supplier of semiconductors.

Many of the components used by Philips in their manufacture of electronic consumer goods, communications equipment, and broadcasting equipment are supplied from within the company. The company's component manufacturers sell more than half of their production to other firms.

GEC, with major interests in telecommunications, industrial control instruments, vacuum tubes, semiconductors, radios, television receivers, and medical equipment, relies on vertical integration only to a limited extent. Its custom-designed integrated circuits are used extensively in-house, and a major portion of GEC's production of relays is used by its telecommunications division. GEC, along with Ferranti, Ltd., and Plessey, recently received a government grant to design integrated circuits for specific applications of British manufacturers.

Thorn, through its subsidiary the British Radio Corporation, has become the largest manufacturer of black and white and color television receivers in the United Kingdom. The group produces its own vacuum and television tubes and relays but purchases all other active and passive components from outside sources.

Strong competition among Britain's component suppliers has restricted any significant vertical integration in the electronics industry to the companies mentioned above. The three other giants in the industry, IBM, the Rank Organisation, and ICL, depend largely on independent suppliers of components. IBM and ICL dominate the British market for large computers. ICL received a $34 million grant from the Government in 1972 for research and development, and another grant of $60 million is currently being negotiated. Rank Radio International, a subsidiary of the Rank Organisation, is a major television manufacturer, and Rank Precision, another subsidiary, produces electronic instruments.

Semiconductor sales accelerate.—Britain's major electronics companies, as well as a number of smaller firms, are large volume users of semiconductors. Sales of semiconductors in 1972 totaled $158 million, an increase of 49% over the 1971 level. Of this total, discrete semiconductors amounted to $113 million and integrated circuits to $45 million. Leading semiconductor manufacturers forecast that output could reach $190 million in 1973 and $250 million in 1975.

Output of integrated circuits is expected to grow three times as rapidly as that of discrete components during the 1973-75 period. Although the computer industry should continue to be the largest IC consumer, there should be increasing utilization in all sectors where adoption of IC's is technically and economically feasible.

The primary factor behind the sharp rise in sales of semiconductors has been the strong demand for color television. Sales estimates for color receivers in 1973 range from $700 million to $950 million. Total 1972 sales of all television sets were estimated at $594 million, representing purchases of 1.3 million color receivers ($450 million) and 1.5 million black and white sets ($144 million).

Production of computers and other electronic capital equipment in the United Kingdom has increased at a slower rate than the production of television receivers. The output of electronic capital equipment grew at a rate of just under 8% annually between 1969 and 1972, and this rate should be maintained through 1975 (see table 2). Accordingly, output should reach $1.5 billion in 1973 and $1.7 billion in 1975.

Labor factors speed automation.—Automation of the component and consumer electronics industries has been stepped up in response to high labor costs and a shortage of skilled workers. In the British electronics industry, labor costs as a percentage of gross output ranged from 14% in the broadcast-receiving and sound-reproducing equipment sector to as high as 33% in the telegraph/telephone apparatus and equipment industry.

Table 2.—United Kingdom: Output of electronic capital equipment, 1969-72
(in millions of U.S. dollars)

	1969	1970	1971	1972[1]
Computers	340	500	463	209
Industrial control equipment	153	183	203	105
Measuring and test equipment	99	113	118	58
Radar	108	152	159	77
Navigational aid equipment	118	125	110	55
Radio communication equipment	139	176	163	92
Other goods	145	160	163	85
Total	1,102	1,409	1,379	681

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[1] First six months.

Source: United Kingdom, Department of Trade and Industry, *Electronic Capital Equipment Survey*.

The geographical concentration of workers in the electronics industry has been the primary factor behind the shortage of labor. Over half of the skilled work force is in southeastern England, where the unemployment level is one of the lowest in the country.

Administrative personnel and skilled craftsmen numbered 221,740 out of a total electronics industry labor force of 402,390 in 1971 (see table 3). A particularly high proportion of administrative and skilled workers exists in the capital equipment sector, where 47,560 people were employed as administrative, technical, or clerical workers; 15,280 as skilled craftsmen; and only 12,940 as unskilled or other production workers. Almost 80% of the labor force in computer plants were either skilled or administrative. The industry's dependence on high quality personnel, coupled with labor shortages, has had a pronounced effect on its desire to introduce the latest in laborsaving machinery.

Outlook is optimistic for electronics industry.—The expansion plans of major manufacturers reflect an optimistic outlook for the British electronics industry. Fairchild Automation Systems, Ltd., plans to establish an MOS manufacturing facility to supply all of Europe. National Semiconductor projects a $2-million investment in a Scottish plant. Motorola, Inc., is completing a new facility in Scotland at a cost of $6 million, and Solidev has announced plans for a diffusion facility in Bedford.

Newmarket Transistors has designated $500,000 for a thick film production plant, while ITT Semiconductors will spend $4 million on plant expansion over the next 2 years. To meet the anticipated growth in demand for color television, Mullard has opened a $24-million plant in Durham to produce picture tubes, and the Sony Corporation has announced plans to establish a plant in South Wales.

Consumer electronics production is expected to grow at the rate of 20 to 25% per year through 1975, reflecting the boom in color television sales. At the same time, the development of advanced equipment should result in increases of 15% per year in the output of the defense electronics sector. British production of industrial electronic goods, stimulated by government policies to encourage industrial capital investment, should show an increase averaging 10% annually during the next several years.

Component Manufacturers' Profiles

A British component manufacturer, part of a large diversified electronics group, specializes in the production of custom-designed *large-scale integrated (LSI) circuits*. This company has 150 employees and a current annual business volume of around $2 million; the latter figure is expected to reach $10 million in 1977.

Although the firm's production and test equipment is specialized, standard techniques are used in processing. Computer-aided design services are used to simulate circuit logic, perform tolerance and transient analysis, and derive the final circuit layout using an interactive display. The company also has fully comprehensive mask-making and test equipment and uses a 120-keV accelerator for ion implantation.

Test equipment currently accounts for about 70% of the company's $750,000 net capital EIPT investment. Total expenditure on EIPT equipment in the period 1973-77 is budgeted at $2.9 million. General assembly equipment, furnaces, photo-litho apparatus, mask-making equipment, scribers, and computer-aided design equipment will be purchased over the next 5 years. Because of the customized nature of the company's production, it is not moving toward

Table 3.—United Kingdom: Occupational structure of the electronics industry, May 1971

Occupation	Electronics industry	Telecommunications	Components	Consumer goods	Computers	Capital equipment
Administrative, technical, and clerical	168,290	28,500	42,040	12,240	37,940	47,560
Craftsmen in skilled occupations	53,450	10,650	14,490	5,910	7,120	15,280
Other production workers	145,930	42,610	56,530	24,820	9,030	12,940
Other employees	34,720	6,950	11,300	6,820	2,950	6,700
Total	402,390	88,710	124,360	49,790	57,040	82,480

Source: United Kingdom, Department of Employment.

automation as quickly as other British integrated circuit manufacturers.

An independent *printed circuit board* (PCB) manufacturer, one of the largest in the United Kingdom, employs 225 people and has current annual sales of $2.2 million. The company has invested heavily in foreign production and test equipment and has imported about 75% of its equipment from the United States. The firm uses screen printers, photoprinters, etching machines, cleaning machines, drilling machines, plating machines, power presses, routing machines, environmental chambers, and NDT equipment. Commercially available equipment is purchased whenever possible, but plating equipment has been built in-house because equipment suitable for production of plated-through-hole boards has not been available.

The firm's net capital investment in production and test equipment is $375,000, and 85% of this is represented by production equipment. During the next 5 years, annual expenditures on EIPT equipment should range between $120,000 and $170,000. The company plans to automate its production processes in order to attract more business from companies requiring long production runs.

An independent manufacturer of passive components, with 2,400 employees and an annual turnover of over $15 million, offers a wide range of products, including *multi-pin connectors, resistors, potentiometers, switches,* and *thick film circuits.* The company concentrates its efforts on high-volume production of hybrid circuits using thick film technology. Output, currently over 12 million microcircuits a year, is now geared to the professional and industrial sectors of the market, lessening the company's earlier reliance on the radio and television industry.

Equipment in use includes three furnaces and a $240,000 computer-controlled laser trimming machine, reported to be one of the first used in Europe. Overall net investment in production and test equipment is $1.5 million, over $1 million of which is in production equipment. About $2 million will be spent on new production and test equipment during the 1973-77 period. The company is firmly geared toward automation of production processes.

End-Product Manufacturers' Profiles

One of the United Kingdom's major *television* manufacturers employs 5,000 people to produce 10,000 units per week, including 4,500 color sets. The present upswing in consumer demand resulted in a fourfold increase in this firm's production of color receivers within a span of 18 months. The company's production line consists primarily of equipment for assembling components purchased from external suppliers, plus the equipment required to produce printed circuit boards, timers, and some transformers for its own use.

This firm has $1.2 million invested in production and test devices. EIPT equipment expenditure, estimated at $325,000 in 1972, is expected to increase 20% per year through 1977. Most of the assembly and test machinery is built in-house because commercial products with the appropriate specifications have not been readily available. About 15% of all test equipment, including storage oscilloscopes, signal generators, and spectrum analyzers, is imported, principally from the United States.

A highly sophisticated *radar equipment* manufacturer, with annual sales of $17 million and a work force of 1,400, spent $500,000 during 1969 alone on equipment for printed circuit board production and testing. The company's EIPT equipment expenditures in 1972 were divided equally between production and test equipment. Investment in test equipment is expected to total $130,000 each year during the 1973-77 period, while purchases of production equipment should continue at their present annual level of $240,000.

This manufacturer plans to place greater emphasis on automated equipment. With the exception of numerically controlled wire wrapping and cable loom equipment, the company tends to buy commercially available products. About one-third of its production equipment was purchased from U.S. manufacturers and an equal amount from other foreign suppliers. U.S. firms have also supplied a substantial portion of the company's test equipment.

Competitive Environment

Domestic manufacture, including end-user in-house fabrication, currently accounts for more than 64%, or over $24 million, of the electronics industry's consumption of production and test equipment (see table 4). Commercial suppliers of EIPT equipment in the United Kingdom held approximately 30%, or $11.8 million, of the production and test equipment market in 1972. An estimated 25% of all production equipment and 40% of all

Table 4.—United Kingdom: Consumption of electronics industry production and test equipment, by source and type of equipment, 1972

(in millions of U.S. dollars)

Source	Production equipment	Test equipment	Total
Locally produced:			
by end-user	4.66	7.80	12.46
by other firms	5.59	6.24	11.83
Imported:			
from the U.S.	3.73	4.10	7.83
from other countries	4.65	1.36	6.01
Total	18.63	19.50	38.13

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on U.K. trade source estimates.

test equipment used was built in-house by British electronics companies in 1972.

The domestic EIPT equipment industry is most competitive in automatic printed circuit board and subassembly test equipment, soldering equipment, and instruments for testing finished equipment. Marconi Instruments, Ltd., and the British Aircraft Corporation are prominent suppliers of automatic test systems for printed circuit boards and subassemblies.

Light Soldering Developments, Ltd., Adcola Products, Ltd., and Weller Electric, Ltd., owned by Cooper Industries, Inc., of the United States, are the leading producers of soldering irons. Jidenco Products, Ltd., Fry's Metals, Ltd., and G. V. Planer, Ltd., are active in soldering machines as well. Marconi Instruments and three manufacturing subsidiaries of U.S. firms—Textronix UK, Ltd., Hewlett-Packard, Ltd., and the Solartron Electronic Group, Ltd.—are the major producers of instruments for testing finished electronic equipment.

Although British manufacturing subsidiaries of U.S. firms mainly supply the local market, about 35% of their output is destined for export. Sales to the European Economic Community are expected to increase as a result of Britain's entry into the Common Market.

The British Government indirectly supports domestic EIPT manufacturers by encouraging electronics companies working under government contracts to use British-made equipment. However, these electronics firms are free to purchase foreign equipment when a comparable local product is not available. The Government provides some direct support to domestic EIPT equipment firms which locate in certain geographical development areas of the United Kingdom. Government grants may cover up to 22% of the total cost of buildings, plant, and machinery and, if the plant is planned for a Northern Ireland site, the grant may approach 40%. Other incentives, such as loans and training assistance, are also available.

American exporters of EIPT equipment supplied an estimated 20% of the total British market in 1972. Imports of the highly regarded U.S. production and test equipment are anticipated to rise through 1977 along with the overall growth of the market (see table 5). Because U.S. companies generally provide excellent technical support for their products in the United Kingdom, they should continue to find a receptive market there.

Trade sources report that U.S. suppliers should be able to increase sales by marketing specialized equipment not yet commercially available in Britain. Although thyristor test devices, capacitance bridges, capacitor winding machines, and modulation depth-measurement equipment have been made largely in-house by British electronics firms, well suited commercial counterparts would be acceptable. U.S. producers could also boost imports in Britain by more competitive pricing of spare parts, often an important consideration in the purchasing process.

Table 5.—United Kingdom: Imports from the United States of electronics industry production and test equipment, 1972 and projected 1974 and 1977

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	3.73	4.90	5.31
Test equipment	4.10	4.68	5.09
Total	7.83	9.58	10.40

Source: U.S. Department of Commerce, Bureau of International Commerce market research study. Values based on U.K. trade source estimates.

Imports from countries other than the United States supplied 25% of the 1972 market for production equipment and 7% of the market for test equipment, for a total of slightly over $6.1 million. Major German suppliers include Willy Aumann, KG; Rohde & Schwartz; Herbert Ruff; and Karl Suss, KG. Active Swiss suppliers are Esec SA, Metar SA, and Meteor AG. The Dutch companies, Eurolectron and NV Philips, and Balzers AG of Liechtenstein, are also significant foreign suppliers.

Customs duties on most types of EIPT equipment imported from the United States into the United Kingdom range from 10 to 17%. In addition to import duty, a value added tax of 10% is payable by importers and manufacturers. Additional information concerning import duties and regulations may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Room 4217, Main Commerce Building, Washington, D.C. 20230.

Technical Requirements

The standard British electrical power supply is 240 volts, 50 hertz, single-phase. Most measurements of length, weight, and pressure use the Imperial system. Although the United Kingdom is converting to metric measurements, it is expected that Imperial measurements will be in common use for some time. More information on technical requirements may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

The following market research survey is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617-M, Main Commerce Building, Washington, D.C. 20230:

"The Market for Electronics Industry Production and Test (EIPT) Equipment in the United Kingdom," DIB 73-11-501, July 1973.

Country Market Briefs

Abbreviated surveys of 10 additional country markets for electronics industry production and test (EIPT) equipment are contained in this section. These *Country Market Briefs* generally are based on reports prepared by the commercial sections of the U.S. Embassies and Consulates in the countries surveyed; in some cases, they may be compiled on the basis of information obtained from other sources.

The Briefs include information similar to that contained in the Country Market Surveys and, to the extent possible, follow the same format.

Brazil

Government and industry efforts aimed at expanding and modernizing production facilities point to growth and development of the already sizable electronics industry in Brazil. The market for production and test (EIPT) equipment in this industry, with annual shipments exceeding $1 billion, should expand as a result of an industrywide objective to increasingly apply modern manufacturing techniques.

Introduction of automated equipment in the electronics industry has proceeded slowly because of limited production levels and the low cost of labor. However, increased demand for high quality electronics products made in Brazil has triggered a move toward increased automation of production processes.

The industry relies on imports of EIPT equipment, as domestic manufacture is limited. U.S. equipment is desired in most cases and therefore holds a strong position in the market.

Selected Sales Opportunities

Prospects are particularly bright for sales of printed circuit (PC) production, inspection, and test equipment. Most of the PC production machinery in current use is obsolete, and the need for replacement equipment is expected to boost sales in this sector.

U.S. manufacturers currently supply about 40% of the test equipment market in Brazil. The quality and reliability of U.S. equipment gives it an edge over lower-priced foreign equipment of lesser quality.

Wiring assembly and other interfacing equipment offer good sales prospects, as do passive component and miscellaneous production equipment, although imports of certain items may be inhibited by high customs duties.

A recent survey conducted by the U.S. Foreign Service in Brazil indicated that the following types of equipment offer the best sales opportunities for U.S. suppliers:

Printed circuit production equipment
- PC cameras
- Cleaning and drying equipment
- Photoprinters
- Etching machines
- Drilling machines
- Component inserting machines
- Silk screen equipment

Wiring assembly and other interfacing equipment
- Point to point wiring equipment
- Strippers
- Terminal installing machines
- Connector assembly machines

Passive component and miscellaneous production equipment
- Customized assembly machines
- Molding presses
- Riveting machines
- Micromaterials handling and positioning equipment

Test equipment for production/inspection of electronic products
- IC test equipment
- Transistor test equipment
- PC board testers
- Diode test equipment
- Resistor test equipment
- Relay test equipment
- Wiring test equipment

The Electronics Industry

The Brazilian electronics industry is composed of approximately 2,700 manufacturers that employ about 140,000 people. The industry's annual output is currently valued at $1.3 billion. Approximately 60% of the total output is accounted for by consumer electronics, 25% by industrial electronics and 15% by military electronics.

Quality and volume of output have been the major problems of the electronics industry. Officials are moving to resolve these problems through the introduction of modern technology and advanced production equipment.

The industry has turned to joint ventures and licensing agreements to speed development. The European Philips group and the American firms of Philco, Motorola, and General Electric have played particularly important roles in this modernization effort. Japanese manufacturers are also demonstrating increased interest in establishing local cooperative arrangements.

One of the present advantages favoring the Brazilian electronics industry is the ready availability of relatively low-cost labor. However, labor costs are increasing and, in order to maintain competitive price levels, manufacturers are stepping up production and are considering increased use of labor-saving equipment.

Government Aids Industry—The Government of Brazil has taken an active role in support of modernization efforts of the electronics industry and is giving priority to the promotion of exports and the substitution of domestic production for imports.

The National Telecommunications Plan, under the supervision of Embratel Empresa Brasileira de Telecomunicacoes, calls for the expansion of the basic microwave system. The National Telephone Plan, under the supervision of Telebras Telefone Brasileiras SA, provides for the installation of 10 million new terminals through 1986. The National Broadcast Plan, supervised by the Ministry of Communications, will revise the radio broadcast system and promote the establishment of FM radio stations. The Government also has plans for a nationwide educational television and radio network.

Expansion Projects Underway—Numerous projects are currently underway in Brazil to expand and modernize production facilities. Philco-Ford operates one of the two local firms manufacturing semiconductors (the other is run by Philips of the Netherlands) and is planning to expand its facilities using machinery and technology similar to that used in its U.S. plants. The firm is also building a plant to provide color TV sub-assemblies for export to the United States. Texas Instruments, the only manufacturer of integrated circuits in Brazil, started production in 1973. It exports most of its output to Europe and the United States and has plans to expand its production line.

Government development plans have enhanced the possibilities for new investments in the electronics industry. New enterprises are being established in the Amazon area to take advantage of free port facilities, fiscal incentives, and abundant low-cost labor. Japanese enterprises such as Sharp and Sanyo are presently installing manufacturing facilities in Manaus.

Competitive Environment

Brazilian manufacture of EIPT equipment is limited to a few less sophisticated electronic instruments, such as meters, low-frequency oscilloscopes, and control devices. The bulk of present demand is being met through imports, and U.S. suppliers are reported to have the largest share of the market.

U.S. manufacturers, for instance, control 40% of the market for test equipment, in spite of the fact that prices of U.S. equipment are generally 10-20% higher than for competing lines from other countries. Japanese manufacturers hold 20-25% of the test equipment market and their products appeal especially to those buyers with whom price is a dominant decision factor.

Domestic manufacturers receive customs protection against foreign competition. All imports of EIPT equipment into Brazil are also subject to a permit issued by CACEX, the agency in charge of controlling prices and quality of such goods.

Brazil uses the Brussels' Tariff Nomenclature system. The rates of duty vary from 0 to 120% of c.i.f. prices. In the case of machinery, a 50% reduction in the rate of duty is granted if there is no similar product available from domestic manufacturers. In addition to customs duties, all imports are subject to the payment of internal taxes.

On-the-spot demonstrations, reasonably competitive prices, training of personnel, and efficient servicing and maintenance are the main selling factors for U.S. manufacturers of EIPT equipment in their marketing efforts in Brazil.

U.S. manufacturers of EIPT equipment would benefit by contacting the various medium-size component manufacturers to offer their know-how. The larger enterprises already have foreign ties and are able to make equipment purchases directly and on their own.

All literature, including flyers, catalogs and operations manuals, should be written in Portuguese.

Bulgaria

Bulgaria's current 5-year Economic Plan (1971-75) and the proposed Plan for 1975-80 call for preferential budgetary allocations for the expansion of the country's electronics industry. Anticipating a large need for foreign capital equipment, the Plans also give the industry high priority for drawing on the country's hard currency reserves to facilitate imports from non-socialist countries.

Total purchases of electronics industry production and test (EIPT) equipment were estimated at $5 million in 1972 and $7.5 million in 1973. The market is forecast to increase at an average annual rate of approximately 24% through 1977, reaching $17.5 million in that year.

Local production accounted for less than $500,000 of the EIPT equipment market in 1972, while imports from CMEA [1] countries totalled about $2.5 million. Imports from other nations amounted to $2 million.

Imports from non-CMEA countries are forecast to expand at a greater rate than the market in general. There is considerable interest in American-made EIPT equipment, and local industry sources anticipate imports from the United States to grow more rapidly than those from other Western nations.

Selected Sales Opportunities

A breakdown of the potential sales for each EIPT equipment subcategory is virtually impossible in Bulgaria. However, the commercial section of the U.S. Embassy in Sofia was able to ascertain those products within each subcategory which offer the greatest sales opportunities to U.S. suppliers.

The categories listed below are in order of procurement priority.

Printed circuit production equipment
- Cleaning and drying equipment
- Photoprinters
- Printed circuit board testers

Wiring assembly and other interfacing equipment
- Point-to-point wiring equipment
    - wire-wrap systems
    - automatic reflow soldering systems
    - automatic welding systems
- Crimping machines
- Measuring machines
- Strippers

It should be noted that although there is a demand in Bulgaria for specialized production and test equipment used in the manufacture of semiconductor components, such equipment is embargoed by the United States and COCOM.[2] Exceptions to the embargo may be possible and a U.S. validated license to export granted on an individual basis in such cases where the equipment and end-products thereof would have solely civilian end-use and other technical considerations were met. Additional information regarding export control regulations may be obtained from the U.S. Department of Commerce, Bureau of East-West Trade, Office of Export Administration, Washington, D.C. 20230.

The Electronics Industry

The Bulgarian electronics industry is composed of three State Economic Unions (Izot, Elektronni Elementi, and Resprom), each of which maintains a number of manufacturing branches.

Izot is by far the largest Union, maintaining 33 branches. The Union is primarily concerned with the production of capital electronic equipment. The firm manufactures the following electronic products within 15 of its plants: Computers, memory systems, magnetic discs, peripherals, recording equipment, analytical equipment, signal relays and contact equipment, ammeters, volt meters, switching control systems, dosimeters, and process control equipment. Some of the computers manufactured are considered third generation; others are second generation, as also are the domestically made peripherals. Production by Izot is almost exclusively destined for the National Unified Information System which, by 1980, will link together all major economic and governmental units in the country.

In addition to its production branches, Izot maintains three research and training facilities, all located in Sofia. The first, Orgproekt, is a scientific research organization which is involved in the design and application of automated control systems. The Cadres Center is a training facility offering instruction in production automation and control, and programs on operation and maintenance of computers and related equipment. The third branch, the Experimental Computer Center, is involved with the experimentation, creation, and maintenance of production and computer control programs.

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[1] Council for Mutual Economic Assistance (also known as Comecon), comprising: Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, Outer Mongolia, Poland, Romania and the U.S.S.R.

[2] Acronym for the Coordinating Committee of the NATO nations plus Japan, less Iceland.

Elektronni Elementi has 12 branches, five of which manufacture the following electronic components: Semiconductors, integrated circuits, contact elements, selenium rectifiers, condensers, resistors and potentiometers.

Resprom is the State Economic Union concerned with the manufacture of radios, television receivers and telecommunication systems. The union maintains 28 branches, one of which is a service facility for manufacturing branches.

Trade Practices

EIPT purchase requests may originate either with the respective State Economic Union (Izot, Elektronni Elementi and Resprom) or the Foreign Trade Organization (FTO), Izotimpex. In either case, however, Izotimpex conducts trade negotiations with the supplier and makes the actual purchase.

Prior to importation of EIPT equipment from Western nations, the following steps must be taken: (1) the State Economic Union or the Ministry of Engineering and metallurgy must ascertain that a similar product is not manufactured locally; (2) scientific institutes, under the jurisdiction of the Committee for Science, Technical Progress and Higher Education, must approve of the product requested; and (3) the State Planning Committee decides whether hard currency should be allocated to pay for the equipment. It should be noted that the last two steps are little more than formalities for U.S.-supplied EIPT equipment.

Upon approval from the State Planning Committee, Izotimpex secures an import license from the Ministry of Foreign Trade and completes the importation process.

The relative influence of any of the above organizations may vary with each transaction and it is therefore difficult to state which one should receive the greatest attention.

In all cases, however, Izotimpex is the organization with which initial contact should be made. Direct access to end-users is discouraged, yet productive discussions with them are possible if the session is arranged by the FTO in conjunction with specific transactions being contemplated.

Electrical power in Bulgaria is supplied at 220 volts, 50hz., but 360 volts, 50hz., 3-phase is also used. Voltage fluctuation is often a problem. Bulgaria uses the metric system of weights and measures.

Additional information concerning technical standards in Bulgaria may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

India

The electronics industry in India, supported and encouraged by the Government in the current 5-year plan (1969-74), is undergoing a period of rapid expansion. The goals of the plan are to assist the industry in attaining early self-reliance, and to increase electronics exports through incentive programs.

Domestic production of electronics industry production and test (EIPT) equipment is minimal and end-users will rely heavily on imports to meet requirements.

Indian imports of EIPT equipment during the Indian fiscal year (IFY) [1] 1973 totaled $10.6 million. Imports of this equipment are expected to expand to $35 million by the end of 1976 and to climb to nearly $52 million by 1979.

The United States supplied 55% of EIPT imports in 1973, with the rest of the market divided between Japan, Germany, and other European suppliers. Indian manufacturers prefer U.S. equipment because of its reliability and accuracy, and U.S. suppliers are expected to maintain their present share of the market.

Selected Sales Opportunities

A survey recently undertaken by the American Embassy in India indicated that the market offers U.S. exporters high sales potential for the following products:

Semiconductor and integrated circuit production equipment
- Masking and stop-and-repeat cameras
- Coordinate measuring machines
- Crystal growing equipment
- Epitaxial growth equipment
- Chemical milling etchers
- Conveyor, diffusion and firing furnaces
- Ion implantation equipment
- Plotters
- Diamond scribing machines
- Thermocompression and ultrasonic bonders
- Precision soldering equipment
- Sputtering equipment

Printed circuit production equipment
- Photoprinters
- Etching machines
- Photoresist systems
- Routers and profilers
- Silk screen equipment
- Protective coating equipment
- Multiple slotting machines

Wiring assembly and other interfacing equipment
- Point-to-point wiring equipment
- Color-coding machines
- Measuring machines
- Connector assembly machines
- Card assembly machines

Passive component and miscellaneous production equipment
- Glass-working machines
- Micromaterials handling and positioning equipment
- Coil winders

Test equipment for production/inspection of electronic products
- Incoming inspection instruments
- Dynamic and linear test systems
- Diode classifier equipment
- Printed circuit board testers
- Environmental test chambers
- Digital systems analyzers

The Electronics Industry

Production of consumer, industrial, and defense electronics products has grown at a rate of over 25% annually during the last 4 years. Continued expansion is expected over the next several years and will result in a growing demand for imported production and test equipment (see table 1).

Assembly of radio receivers has been the prime activity of the Indian electronics industry since the late 1940's. Output expanded slowly until 1954, when the Government imposed a restriction on imports of radio receivers. India's radio industry began to flourish under this protection and was given an additional boost with the advent of transistorized receivers in the 1960's. Production grew from 1 million units in 1955 to 19 million in 1972.

Radio production showed gains not only in quantity but also in quality. In addition, an industry that formerly concentrated on the assembly of imported components has now become essentially self-sufficient.

Other consumer electronic goods produced and assembled in India include TV receivers and tape recorders. In both areas, Indian firms are striving to reduce the import content of the final product and are meeting with some success. The import content in domestically produced TV sets has been reduced to 16%, and officials expect the tape recorder industry to be completely autonomous within a year.

The Indian computer industry, strengthened by licensing agreements with foreign firms, is expanding production. Two foreign computer companies are operating in the country. IBM was granted a license to recondition 68 computers of their 1401 series and ICL has a license to manufacture 48 systems of their 1901A series in collaboration with Bharat Electronics Limited.

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[1] Indian fiscal year is from April 1 through March 31. All figures unless otherwise noted will be based on IFY.

The Electronics Corporation of India, a wholly Government-owned company, has developed the TDC-12 computer system, and has gained approval from the Electronics Commission to manufacture a series of more advanced small-to-medium size computers, the TDC-16 and the TDC-32. The corporation expects to produce $6.7 million worth of computers annually by 1976.

The components manufacturing industry is undergoing rapid growth in India. Production of transistors and diodes, recorded at 28 million units in 1971, increased from 35.2 million in 1972 to 140 million in 1973 (see table 2).

The Government of India has played a prominent role in the development and expansion of the Indian electronics industry. Two major manufacturing entities, the Indian Telephone Industry and Bharat Electronics Limited, were established in the 1950's under government ownership.

A recent government plan, to be finalized by the Trade Development Authority, would establish a duty-free export processing zone located within 7 kilometers of the Bombay International Airport in Santa Cruz. The zone will be devoted exclusively to the development of exports of electronic products. A target of $100 million in exports annually by 1977 emphasizes the development of technological capabilities, rather than simply setting up manufacturing and assembly operations. Some 28 companies from the United States, Japan, and West Germany have shown interest in the project by establishing joint venture, licensing or marketing arrangements.

In 1971 the Government formed an Electronics Commission. The Commission has been charged with the task of reviewing research, development and industrial operations within the electronics industry. It has full authority to formulate policy and to implement all measures, both promotional and regulatory, that are deemed necessary to establish a self-reliant and integrated electronics industry in India in the shortest possible time.

The Commission currently is engaged in assessing production capacity and formulating measures to promote the industry and enlarge production for both domestic consumption and exports. Proposals under consideration include offering export incentives, designating free-trade zones and establishing industries oriented entirely to production for the export market.

Producer Profiles

BHARAT ELECTRONICS, LTD. (BEL) manufactures transceivers, transmitters, radar, specialized components, radio receiving tubes, transistors, X-ray tubes, TV picture tubes and cathode ray tubes and a variety of other equipment. Gross value of production showed a tenfold rise during the 10-year period which ended March 31, 1971.

The plant is owned by the Government of India. It was designed, constructed and equipped under technical collaboration with Thomson-CSF of France and began operation in 1956.

BEL has developed a program of import substitution through the manufacture of both production equipment and components. It saved $110 million in foreign exchange from 1956 to 1971. Despite the introduction of new products and the upgrading of existing product lines, the company was able to reduce the foreign content of its production to 29% in 1971 compared to 32% in 1970 and 35% in 1969.

BEL's well-equipped research and development facilities have introduced 14 types of receiving tubes, five types of transmitting tubes, five types of cathode ray tubes, and an X-ray tube. The company has manufactured storm warning radar for the Meteorological Department, and a cyclone warning radar system is expected to be ready in 1974. Among items currently under development is a complete range of HF, VHF and UHF communication equipment.

The firm recently placed orders for plant and machinery for the production of TV picture tubes under license arrangements with Nippon Electric of Japan and has plans to undertake manufacture of TV transmitter and studio equipment in collaboration with Fernsch of West Germany and Nippon Electric. It also plans to begin manufacture of integrated circuits.

Another planned activity is the manufacture of a desk calculator which was developed in collaboration with the Jadavpur University.

BEL is completing construction of a plant for the production of X-ray equipment and has received approval to begin construction of a complex for the manufacture of microwave and radar apparatus.

THE ELECTRONICS CORPORATION OF INDIA LD. was incorporated in 1967 and is owned by the Government of India. Production activities have been organized into divisions based on product groups. Total value of production by the Electronics Corporation of India in 1971 was $2.7 million, an increase of 62% from 1970.

The Corporation's Nuclear and Allied Instrumentation Division produced transistorized modular nuclear instrumentation, high performance oscilloscopes, closed-circuit television equipment and medical electronic equipment valued at $1.2 million in 1971.

Products made by the Resistors and Capacitors Division and the Semiconductors Division included electronic components such as carbon and metal film resistors, high megohm resistors, tantalum capacitors, wire-wound potentiometers, zener diodes, germanium power transistors and thermo-electric cooling modules. Production was valued at $300,000 in 1971. The Servo Controls Division concentrated on the development of the first small a.c. gear motor produced in India. This unit, designated the AC510, went into commercial production during the fall of 1971. Total 1971 production was valued at $100,000, which included components for X-Y instrumentation.

The Power Reactor Instrumentation Division, which manufactures instrumentation and control systems for nuclear power stations and allied plants, had a total production of $800,000 in 1971, while the Computer Division produced India's first on-line digital computers and a variety of software with a total 1971 value of $200,000.

The Microwave Division has concentrated on the development of microwave test instruments and components for commercial production. The Special Products Division was established in 1970 to manufacture equipment which was developed at the Bhabba Atomic Research Center for defense requirements.

In 1971 the Corporation initiated a 5-year expansion program calling for cumulative capital investment of $15.3 million by the end of 1976. Employment by 1976 is predicted to reach 5,200 and sales are expected to rise to $30 million.

A significant feature of the expansion program is the role played by the corporation in the development and manufacture of small- and medium-size computers. Production of computers is expected to total over $6.7 million by 1976.

The Special Products Division is expected to have annual sales of $1.6 million by the end of the five-year plan period, and a target of $600,000 million has been set for the Microwave Division.

The Corporation's Television Division manufactures commercial television sets. Production activity includes the manufacture of a few critical components, assembly and testing. The Division has set a sales target of $4 million annually by the end of the plan period.

Competitive Environment

There are four Indian firms which manufacture EIPT equipment. Philips India Limited in Bombay produces point-to-point wiring equipment, strippers, crimping machines, wafer probing equipment, diode testers, wire bond testers, linear test systems, and X-ray inspection equipment. Associated Instrument Manufacturers Limited (New Delhi) manufactures frequency counters, moisture meters, photoresist systems and high vacuum feed-throughs. Electronics test equipment (standard signal generators) is produced by the English Electric Company in Madras, and Toshniway Industries in Ajmer turns out ultrasonic cleaners and bonders and transistor test equipment.

None of these manufacturers has any equity involvements or licensing arrangements with U.S. firms, and their entire production of EIPT equipment is absorbed by the domestic market.

Table 1.—India: Manufacture of Electronic Equipment, 1965, 1972, and projected 1975.
(in millions of U.S. dollars)

	1965	1972	1975
Radio receivers and other consumer products	22.7	107.0	10.0
Low power radio communications equipment	5.0	14.0	78.0
Microwave systems and associated equipment including radar and navigational aids	2.3	14.4	76.0
Electronic equipment for line communications systems	4.5	11.1	34.7
Computing, data processing, nuclear and other equipment	0.6	10.4	44.0
Test Instruments	—	4.0	9.0
Total	35.1	160.9	331.7

Table 2—India: Production of Electronic Components, 1970–73.
(in millions of units unless otherwise indicated)

	1970	1971	1972	1973
Vacuum tubes	5.0	5.1	6.1	6.0
Transistors and diodes	23.0	28.0	35.2	140.0
Carbon resistors	85.0	85.0	140.0	500.0
Paper and mica capacitors	16.0	10.1	16.0	50.0
Electrolytic capacitors	20.0	13.4	13.5	63.0
Styroflex and plastic capacitors	31.0	28.0	30.0	140.0
Ceramic capacitors	28.0	37.0	51.0	150.0
Trimmers	10.0	15.0	16.0	50.0
Loudspeakers	4.5	5.0	3.3	8.0
Gang condensors	3.5	4.0	3.3	8.0
Potentiometers	5.2	5.5	4.7	22.0
Band switches	2.2	3.0	3.5	10.0
Connectors	—	50,000 pcs	50,000 pcs	3.0
Relays	—	50,000 pcs	50,000 pcs	2.0
Picture tubes	—	2,315 pcs	12,030 pcs	100,000 pcs
Ferrite rods and cores	—	—	144 tons	—
Permanent magnets	—	—	410 tons	—

Ireland

The Irish electronics industry is undergoing significant expansion on the strength of incentives offered by the Government and the relatively low cost of labor.

The base and output of the industry is expected to continue growing as producers begin to take advantage of the huge duty-free European market now opened through Irish membership in the European Economic Community. In order to realize the full potential of the expanded market for their products, Irish manufacturers feel that they will have to double their annual purchases of electronics industry production and test (EIPT) equipment by 1977.

Consumption of EIPT equipment in 1973 was estimated to exceed $8 million, up 51% from the 1972 level of $5.3 million. Local trade sources estimate the market will increase 17% annually and reach $15 million in 1977.

The domestic market for EIPT equipment is supplied, for all practical purposes, by imports. The United States commands a substantial share of the market, supplying about 75% of total industry requirements. Local manufacture, carried on in a small scale by only a few firms, is limited to simple test apparatus.

Approximately 30%, or $1.6 million, of Irish EIPT equipment purchases in 1972 consisted of test apparatus. The remaining $3.7 million was invested in equipment for the production of computers and related equipment ($900,000); semiconductors, capacitors, rectifiers, transistors, diodes, varistors and power transistors ($1.7 million); core, memory stacks and memory systems ($320,000); circuit assemblies ($150,000); and miscellaneous production equipment ($600,000).

The Electronics Industry

Domestic production of electronic products totaled approximately $92 million in 1972 and is forecast to grow at an average annual rate of almost 18%, reaching approximately $200 million in 1977. Output of components, including capacitors, transistors, diodes, rectifiers, varistors, electron guns, and circuit assemblies, amounted to about $35 million in 1972 and is expected to reach well over $100 million in 1977.

Manufacture of general purpose computers and peripherals totaled $17.5 million in 1972; cores, memory stack and memory systems amounted to $6 million; computer process control equipment, $24 million; processing instruments and systems, about $2 million; test equipment and high-powered transmitters, about $1.5 million; electronic equipment for the telecommunications industry, almost $4 million; and instruments for automatic chemical analysis, $30 million.

Computers and related equipment, process control devices, and analytical instrumentation should witness large production increases in the next 5 years. Due to government plans for telecommunications services, electronic products for the telecommunications industry are also expected to rise sharply, from less than $4 million for 1972 to approximately $25 million in 1977.

There are close to 20 firms manufacturing electronic products in Ireland, excluding consumer assembly firms. The industry is dominated, in terms of both number and size of entities, by U.S. affiliates. ECCO and E.I. (subsidiaries of G.E.), Core Memories (Data Products Corporation), Measurex Ireland (Measurex), Technicon Ireland Ltd. (Technicon), and Digital Equipment (Digital International) are among the largest firms operating locally.

Spurred on by encouragement from the Irish Government and the advantages of Irish membership in the EEC, the country's electronics industry is growing rapidly. It has been estimated that the phasing out of the EEC Common External Tariff could result in an increase in gross profits of between 110 and 150% on electronic goods exported to the member nations. ECCO, Digital, and Core Memories, anticipating accelerated demand, are undertaking major expansion programs. Northern Electric and Measures are in the primary stages of production and the Irish Development Authority (IDA) has stated that four more companies are expected to set up facilities within the next 2 years.

While the vast majority of companies appear to be using advanced EIPT equipment, many are only semi-automated, relying to a great extent upon Ireland's supply of low-cost female labor. The labor situation is changing rapidly, as wages have increased 14.5% annually for the past few years, thereby encouraging many local firms to automate production.

The Irish Government, through the IDA, is actively promoting industrial development and is particularly interested in industries whose production involves a high technology content, high export ability, good growth potential, and high spin-off benefits. As such, electronics firms, particularly those employing production and test equipment, are most welcome. Incentives offered by the IDA include: A tax exemption for 15 years on export profits; grants toward the purchase of fixed assets, including equipment; training and technical assistance grants; loan subsidaries; and ready-built factories.

Producer Profiles

EEC LTD., a subsidiary of General Electric, was founded in 1966. It has expanded rapidly and now employs over 1,600 persons, mostly women. The current cost value of ECCO's capital investment in EIPT equipment is approximately $7 million, about 91% of which is production equipment. Production operations are described as "semi-automatic."

EECO has been making transistors, diodes, and rectifiers. However, it is currently embarking on a major expansion program and will spend nearly $2 million per year for the next 4-5 years on purchases of EIPT equipment for the manufacture of varistors and power transistors. Annual production is expected to rise from about $20 million in 1972 to $80 million in 1977.

TECHNICON, IRELAND LTD., a subsidiary of Technicon Instruments of New York, was established in Ireland in 1966. It has expanded twice since then and now employs over 500 people. The current value of Technicon's capital investment in production equipment is $1.5 million and investment in test apparatus amounts to $500,000. The firm's expenditures for EIPT equipment, mainly test equipment, will run about $50,000 annually over the next few years. Annual production volume is running about $30 million and is expected to rise 10% annually. Production operations are currently semi-automatic.

Korea

The Korean electronics industry has experienced a period of rapid growth in the production of components and consumer and industrial electronics equipment. Output advanced at an annual growth rate of 62% from 1968 to 1972, expanding from $43.9 million to $208 million. This growth rate is expected to continue, indicating that the annual output of Korean electronic products could reach over $1.1 billion in 1977. The expanding production will be channeled to feed a burgeoning world market. Government officials have targeted a level of $2.5 billion in Korean electronics exports by 1980. To insure that Korean electronics plants will be able to meet the increased demand, the Government has moved to implement procedures to encourage new plant formation, along with modernization and expansion of existing production facilities.

As a result, the Korean market for electronics industry production and test (EIPT) equipment, which totaled $16 million in 1972 and expanded to an estimated $26.7 million in 1973, is expected to reach $58 million in 1977.

Korea will continue to rely heavily on imports of EIPT equipment to carry out its long-range expansion plans, since domestic manufacture of such equipment is minimal and is anticipated to remain so for the next several years.

Japan, which has traditionally dominated Korea's EIPT equipment market, supplied 62% of the total in 1972, while imports from the United States accounted for 21%. However, U.S. suppliers are becoming increasingly competitive as a result of technological advantages and the recent dollar devaluations.

Selected Sales Opportunities

The largest share of the market is accounted for by test equipment, which was estimated at $4.7 million in 1971 and $14.6 million in 1973. Trade sources predict a rise to an annual $30 million level by 1977. High growth is also predicted for the production equipment market, which is forecast to expand from $3.9 million in 1971 to $28 million in 1977.

Recent market research conducted by the U.S. Embassy in Korea for the Department of Commerce indicates that the following standard and specialized equipment will present excellent sales opportunities for U.S. manufacturers:

Printed circuit production equipment
- PC cameras
- Cleaning and drying equipment
- Photoprinters
- Etching machines
- Drilling machines
- Electroplating equipment
- Photoresist systems
- Component inserting and sequencing machines
- Routers and profilers
- Silk screen equipment
- Protective coating equipment
- Multiple slotting machines

Wiring assembly and other interfacing equipment
- Color coding machines
- Terminal installing machines
- Cable harness equipment

Passive component and miscellaneous production equipment
- Custom and special assembling machines
- Riveting machines
- Micromaterials handling and positioning equipment
- Metal finishing machines
- Coil winders

Test equipment for production/inspection of electronic products
- Resistor test equipment
- Printed circuit board testers
- Environment test chambers
- Integrated circuit test equipment
- Transistor test equipment
- Digital system analyzers
- Oscilloscopes
- Leak detectors

The Electronics Industry

Korea's export-oriented electronics industry will continue to expand rapidly in an effort to satisfy the world's rising needs for sophisticated electronic consumer and industrial products. Domestic production is forecast to increase nearly 40% annually during the 1972-1980 period, going from $208 million to approximately $3 billion.

Korean output of consumer electronics products was valued at $55.3 million in 1972, industrial electronics at $25.3 million, and components at $127 million. Exports within the same year exceeded $142 million, or 68% of total production. Electronic end-products accounted for $38.6 million in exports and components $103.5 million. Officials predict that exports will total $2.5 billion in 1980 and will comprise over 80% of total production.

Inflows of foreign commercial capital have played a major role in bringing the electronics industry to its present level of production. Korea's large supply of low-priced, efficient labor has proven attractive to foreign investors, resulting in a number of export-oriented assembly operations.

Foreign investment in the electronics industry at the end of 1972 reached nearly $57 million, of which approximately $30 million came from the United States. In that year, there were 288 electronics manufacturing firms operating in Korea, of which 253 were locally owned, 26 were local-foreign joint ventures, and nine were foreign firms. American-owned companies now operating in Korea, and each employing more than 300 workers, are Fairchild Semikor, Ltd., Signetics Corp., Motorola, Inc., Control Data Far East Inc., and Applied Magnetics Corp.

Government Programs—The Korean Government has designated the electronics industry as a strategic sector of the economy and has formulated a Basic Plan for Electronics Industry Promotion under which the following electronics export goals were established: $300 million for 1973; $450 million, 1974; $630 million, 1975; $850 million, 1976; $1.1 billion, 1977; and $2.5 billion, 1980. In order to meet these export goals, local production capacity will have to be increased 16 times over its 1972 level.

With the objective of diversifying and strengthening the production base, the Korean Government recently formulated an ambitious plan for electronics plant construction. The plan calls for the establishment of 87 new plants in 1974, 53 in 1975, 91 in 1976, and 77 in 1977, thus increasing the number of plants from 288 in 1972 to 767 by 1980. Of the projected total, 202 plants would be for production of consumer electronics, 79 for industrial goods, 462 for electronic components, and 24 for other electronic materials. To insure diversification of product base and competitiveness in the world market, future construction of plants will be scrutinized on the basis of international competitive advantage of each product to be manufactured.

Additionally, Government incentives will be continued to attract foreign capital and technology through long-term low-interest financing, establishment of training programs to assure an adequate supply of highly trained manpower, elimination of governmental red tape, and extension of certain tax exemptions on newly developed electronic products. The Government has established two institutes designed to increase the technological competency of the local industry. The Korea Institute of Science and Technology, founded in 1966 with aid from the U.S. Government, carries out research and development projects for Korean industry and the Government. The Fine Instrument Center, a joint project of UNESCO and Korea's Ministry of Commerce and Industry, conducts training programs in the operation and maintenance of scientific and industrial electronic instruments. Training programs of the latter cover such topics as digital and transistorized circuits, electronic measuring apparatus, electron microscopes and principles of quality control.

Producer Profiles

GOLD STAR CO., LTD., of Seoul, is one of the largest consumer electronics manufacturers in Korea and was the leading exporter of electronic products in 1972. The Gold Star plant in Pusan employs 2,700 people and produces TV and radio receivers and cassette tape recorders. Total capital equipment is estimated at $2.6 million, approximately $1.5 million of which is in test equipment. Present annual production is reported to be 400,000 radios, 100,000 TV receivers and 100,000 cassette tape recorders, valued at $175 million in total. Gold Star has a technical licensing agreement with a Japanese firm. Many of the components for the manufacture and assembly of TV and radio receivers are imported.

A-NAM IND. CO., located in Seoul, is Korea's largest assembler of electronic parts and components, manufacturing silicon transistors, and MOS and hybrid integrated circuits. It was the leading exporter of electronic components in 1972, exporting $9.8 million in such components, mostly integrated circuits, to the United States. The plant employs 1,600 people. Total capital equipment is estimated at $2.5 million, of which approximately 50% is in testing equipment. The company depends on imports to provide most of the materials necessary to assemble its components.

A-Nam plans to produce color TV sets for export under a 50-50 joint venture with Matsushita Electric Company of Japan. The plant will have a monthly production capacity of 3,000 to 10,000 units. In addition, Matsushita is reported to be considering a loan to A-Nam of up to $10 million for the expansion of A-Nam's existing facilities.

Competitive Environment

The domestic output of EIPT equipment in Korea is limited to a few electronic firms producing equipment for in-house use and to about 15 firms manufacturing equipment of simple design on a made-to-order basis. Most firms depend on imports to meet their equipment needs.

The market for EIPT equipment is dominated by imports from Japan and the United States. The U.S. share, 21% in 1972, is expected to increase to 23% in 1974 and 25% in 1977, while Japan's share is expected to decline.

Japan has been dominant in the market as a result of geographical proximity and the sizable Japanese investments in Korea. A large Korean trade deficit exists with Japan, and the Government is working to reduce this by taking steps to encourage imports from third countries. Because U.S. equipment has been made more competitive by reason of the dollar devaluation, Korean manufacturers are turning more to the purchase of American EIPT equipment.

Japanese firms have established several joint ventures with Korean machinery and equipment manufacturing companies. There were no U.S. subsidiaries or licensees manufacturing EIPT equipment in Korea at this writing. However, seven U.S. electronic firms had undertaken independent or joint investment projects, and were expected to file investment applications with the government. ITT planned to construct a $2.5 million electronic parts plant at the Juan industrial complex in Inchon, with the capacity to manufacture $10 million of integrated circuits annually.

Fairchild planned an independent venture for the production of integrated circuits; Corning Glass a joint venture with Samsung Electronics Co. for the manufacture of Braun tubes; Owens Illinois a joint venture with Hankuk Glass Industry Co. for production of Braun tubes; Oak Electronics plans to make printed circuit boards; General Time for production of timers; and TRW with Yongjin Industry (50-50) for manufacture of integrated circuits. Among other U.S. firms which have shown interest in establishing Korean manufacturing facilities are Radio Corporation of America, General Telephone and Electronic and General Instrument.

Trade regulations.—Import licenses, required for most Korean imports, are granted only to local firms registered as "qualified foreign traders" with the Ministry of Commerce and Industry. Such registration requires that certain minimum standards be met (e.g. the firm must export no less than $500,000 annually). These restrictions do not apply to imports associated with foreign investment projects under the Foreign Capital Inducement Law. The bulk of Korean EIPT equipment imports are neither prohibited nor restricted by quotas. Although the Korean Government provides protection to local industry by restricting importation of comparable products to those made domestically, this has had no major effect on the import of U.S. EIPT equipment.

Market development.—In order to compete effectively in the Korean market, U.S. suppliers should generate a strong presence through public advertising, sales calls, exhibitions and good communications between supplier and importer. Because of the high interest rates on commercial loans in Korea, sales opportunities will be enhanced by a willingness to extend generous terms of credit.

Portugal

Although Portugal is a small country still in the stages of basic economic development, it has a thriving electronics industry. This sector of the Portuguese economy was created by foreign-owned firms to supply semi-finished and finished electronic components to the computer and telecommunications industries in the United States, Europe and Japan.

The demand for electronics industry production and test (EIPT) equipment in Portugal has grown in support of the specialized product lines of the foreign subsidiaries. At present, semiconductor production accounts for approximately half of the EIPT equipment market demand.

Looking further into the future, local industry sources suggest that test equipment and computerized monitoring and inspection systems will account for an increasingly larger share of EIPT purchases. Passive competent production equipment is estimated at 30% of the market, while printed circuit production and interfacing equipment account for approximately 20%.

Portugal has been quite receptive to foreign investment. With Portuguese Government fiscal incentives and an adequate supply of low-cost labor, foreign enterprises have eagerly entered this country to set up labor-intensive operations. In 1965, only three electronics plants were operating in the country, with an annual value-added production of $7 million. Today, there are 15 firms, and their value-added production is estimated to be in excess of $50 million annually. Total shipments of the industry in 1972 were valued at about $150 million, but this figure overstates the actual size of the industry, since most parts and raw materials are imported, assembled and reexported.

Nearly all electronics firms in Portugal operate in free zones or on drawback arrangements. To a limited extent they provide complementary markets for each other, but most finished products are sold back to the parent firms or shipped to end-user industries in Europe and the United States.

The growth of the electronics industry in Portugal is directly linked to two factors: (1) the expansion of output of existing firms; and (2) the entry of new firms into the market. Most of the existing firms are relatively new, and many plan to expand their output over the next few years. With the problems of the initial start-up period behind them, these plants expect to increase their productivity through more efficient utilization of an increasingly skilled labor base. The established firms also hope to improve their access to European markets through Portugal's bilateral trade agreement with the European Economic Community. With regard to the expansion of the industry, at least three U.S.-based firms are presently investigating conditions and sites in Portugal for new production facilities and several German firms are also known to be interested. The Portuguese Government no longer encourages labor-intensive industries to locate in Lisbon, Setubal or Oporto because of the concentration of industry in these areas. However, the Government's fiscal incentive program still applies to plants established on the fringes of these areas or in other non-industrialized parts of the country.

A Ministry of Economy source recently predicted that within 5 years the number of electronics firms in Portugal should increase to 25 or 30 and production would more than double. Although this prognostication may be inflated, it seems certain that if the electronic industries of Europe and the United States continue to grow, Portugal's budding industry would expand correspondingly, as also would the market for EIPT equipment.

Romania

Romania's 1971-75 Economic Plan allocates 25% of the country's investment resources to the electrical/electronics industry. Its goal is to increase production of electronic and electrical goods by 150% over the 5-year period. The industry is placing emphasis on development of the following electronic products: Pressure instruments and apparatus, minicomputers, hydrogen and sodium lamps, television circuitry, and computer peripherals. The annual plan for 1973 called for output of the electric and electronic industry to reach 2.8 billion lei,[1] about 10% of which was to be attributable to measuring and control instruments.

Local sources expect Romania to increase its purchases of electronics industry production and test (EIPT) equipment to keep pace with the rising production of electronic equipment. American EIPT equipment is favored in Romania, and local sources expect domestic manufacturers to continue purchasing U.S. equipment.

The Electronic and Vacuum Technique Industrial Central Organization plans to place more than 500 new electronic items into production by the end of the present 5-year plan in 1975. Under the jurisdiction of this organization is the country's only computer production facility, the Electronic Computer Factory (F.C.E.). In addition to computers, this plant produces transistorized centralizing and invoicing machines, office machines using cathode ray tube displays, and other electronic equipment.

Another facility of interest is the Factory for Electronic Measuring and Industrial Instruments. This plant manufactures a wide variety of electronic measuring instruments for industry and research, including such items as frequency modulation telecommunication devices, d.c. voltage sources, electric vibrometers and electric tensiometers.

Two large production units, the Electronica Works in Bucharest and the Enterprise for Radio Components and Semiconductors I.P.R.S. in Baneasa, are presently responsible for Romanian production of electronic components. Manufacturing centers on electro-mechanical passive components, potentiometers, semi-adjustable carbon film resistors, variable capacitors, fixed film resistors, insulated resistors wound on glass support, ceramic thermistors, styroflex capacitors, insulated ceramic capacitors, thyristors (germanium and silicon), and signal and switching diodes.

Trade Practices

Purchases of EIPT equipment are contracted principally by the Foreign Trade Organization (FTO), Electronum. The FTO may be influenced in choosing a supplier by the advice of its end-user enterprises. However, foreign suppliers may contact end-users of EIPT equipment only at the invitation of, or with the permission of, Electronum. The choice of a trading partner in significant transactions is subject to review by the Ministry of Machine Tools and Electronics. To sign a purchase contract, Electronum must receive verification from the Bank for Foreign Trade that sufficient hard currency is available to pay for the equipment. Upon verification, Electronum will invite bids from foreign suppliers. Where little or no hard currency is available, the FTO can purchase from Western countries only on a barter basis.

Romania is flexible with regard to types of business ventures permitted and engages in conventional purchasing transactions, licensing, and even direct foreign capital investment in the electronics field.

Sales negotiations are often long and arduous. The entire process may vary from a few months on normal sales to a few years on major transactions.

Electric network voltage is 380/220 volts, 3-phase, 50 Hz. In certain localities the voltage is 227/120 volts, 3-phase. The country uses the metric system of weights and measures.

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[1] Official exchange rate US $1 = 4.97 lei.

Switzerland

The Swiss market for electronics industry production and test (EIPT) equipment was estimated at over $17 million in 1973, about 14% above the 1972 level of $15 million.

Local industry sources predict that due to anticipated demand for electronics products and the rising cost of labor, the EIPT equipment market will reach approximately $25 million in 1977.

Close to 90% of the market, or $13.5 million, was supplied by imports in 1972. Local production, either for in-house use or for sale, accounted for the remaining 10% of domestic consumption.

The United States was the major supplier to the Swiss market in 1972, accounting for more than 44% of total imports, or $6 million. Sales of U.S. EIPT equipment in the Swiss market are expected to remain high, as local electronics manufacturers show a decided preference for U.S. production and test equipment.

Selected Sales Opportunities

During the 1973-77 period, Switzerland is expected to consume over $100 million of EIPT equipment. According to trade sources aggregate U.S. sales of EIPT equipment will surpass $40 during the same period.

The production of semiconductors, integrated circuits and passive components is expected to grow 10% annually through 1977. Printed circuits (PC) production equipment sales, valued at $4.5 million in 1972, are expected to rise to $7.2 million in 1977.

Sales of wiring assembly equipment along with test and inspection devices are expected to rise as the Swiss machine tool, watch, instrument and apparatus control industries increasingly "go electronic."

The Swiss market for wiring assembly and other interfacing equipment was estimated at $2.3 million in 1973 and is expected to grow annually by approximately 15%, reaching $3.5 million in 1977. Expenditures for test equipment should increase from $5 million in 1972 to $9 million in 1977.

Since the tight labor situation is not expected to improve through the 1970's, prospects are exceptionally bright for production and test equipment, especially of the type that presents custom solutions to the problems of rationalization, automation, and higher productivity.

A market research study recently conducted by the U.S. Embassy in Switzerland, reveals favorable sales prospects for U.S. suppliers of the following EIPT equipment:

Semiconductor and integrated circuit production equipment
- Masking cameras
- Epitaxial growth equipment
- Ion implantation equipment
- Ultrasonic bonders
- Diffusion furnaces

Printed circuit production equipment
- Photoprinters
- Etching machines
- Chemical milling etchers
- Photoresist systems
- Silk screen equipment
- Plotters
- Thick film equipment
- Multiple spindle drills
- Flexible circuit equipment
- Protective coating equipment

Wiring assembly and other interfacing equipment
- Wire-wrap systems
- Automatic soldering systems
- Crimping machines
- Cutters
- Strippers

Passive component and miscellaneous production equipment
- Custom and special assembly machines

Test equipment for production/inspection of electronic products
- Integrated circuit test equipment
- Transistor test equipment
- Wiring test equipment
- PC board testers
- Thick-thin film resistor trimmers
- Wafer probing equipment
- Wire bond testers

The Electronics Industry

Output of the Swiss electronics industry was estimated at $120 million in 1972, and local trade sources expect the industry to grow at an annual rate of 15%.

For purposes of discussion the Swiss electronics industry is divided into three sections: (1) PC manufacturers; (2) other component manufacturers and (3) manufacturers of electronic sub-assemblies and end-products.

PC manufacturers.—After exceptional peaks in the late 1960's and early 1970's, capital investment appeared to stabilize in the PC industry. A decrease was reportedly recorded in 1972, due to keen competition from foreign producers and an apparent overcapacity to produce PC's in Switzerland. However, demand for PC's began to climb in 1973 as demand for consumer electronic products increased.

Much of the demand has been spurred by the switch to automated equipment to compensate for the lack of skilled labor. Manual, mechanical, and pneumatic controls are gradually being substituted in systems designs. All of these advances contribute to an increase in the use of printed circuit design. However, it should be remembered that much of the production equipment used is custom-made and that production rates are, on the average, smaller than in the United States.

Other Component Manufacturers.—Five local companies presently manufacture semiconductors, transistors, IC's and custom circuits, supplying approximately 8% of Switzerland's requirements. Total consumption of semiconductors and IC's was estimated at $17.5 million in 1973. The total market for capacitors and other passive components reached approximately $7 million; less than 10% of production in this subcategory was supplied by local manufacturers.

The high cost and scarcity of labor, combined with governmental programs aimed to inhibit the influx of foreign workers and reduce inflation, tends to limit industrial expansion. Additionally, existing manufacturing facilities of U.S. component companies in Europe are expected to supply much of Switzerland's needs for the near future. Moreover, the recent creation of Eurosil (Munich, Germany), a joint venture of Intersil, Inc., (Cupertino, California) and SSIH (the Swiss producer of Omega and Tissot watches), formed to manufacture COS/MOS circuits and liquid crystals, is expected to satisfy much of the local demand for components. Nonetheless, production of basic components should grow at a steady rate of 10% yearly. Production is expected to center on custom products unobtainable from other sources.

The Polytechnical Schools of Lausanne and Zurich are engaged in the research of electronic components and reportedly plan to acquire small diffusion furnaces.

Manufacturers of Electronic Subassemblies and End-products.—The largest sector of the estimated $120 million annual electronics industry is the manufacture of industrial products. Some 100 companies are relatively large manufacturers in this sector, producing the following equipment: Communication equipment including that for the military; machinery and appliance controls, including industrial process and numerical control for machine tools; and medical electronic equipment.

Until recently, the Swiss consumer electronics industry was relatively small, consisting of a few manufacturers of high quality tape recorders and other audio products. With the advent of electronic time pieces, however, the Swiss watch industry has gradually entered the electronics field. Local trade sources believe that 1973-74 will be crucial years for the industry. Optimistic forecasts project world production to reach 100 million electronic time pieces by 1980, a substantial share of which will be attributed to the Swiss.

Government Programs

The Swiss Government (notably the Post, Telephone and Telegraph Agency (PTT), the federal railroads and the Military Department) is an important purchaser of electronic equipment. PTT is currently testing a solid state exchange produced by Hasler, AG. An important PTT project that may replace present electromechanical telephone exchanges is presently under development and hopefully will be realized by the 1980's. This will be a pulse code modulation telephone system. Hasler, Standard ITT and Albiswerk-Siemens currently are involved in the project. The PTT also plans to purchase a satellite telephone communication system to become operational in the 1970's.

The extensive network of the Swiss railways will be computer-controlled by 1980. The Military Department reportedly places regular and substantial orders for communications equipment and other electronic devices with Swiss and foreign contractors. Other facilities that regularly place large orders for electronic products include: airports and radio and television stations serviced by the PTT and operated by the Swiss Radio Corporation; the Radio Swiss navigational and telex network; the CERN (European Center for Nuclear Research); and the Battelle Institute Laboratories in Geneva.

Producer Profiles

The country's largest (and a typical) manufacturer of semiconductors and integrated circuits is Faselac SA, of Zurich. The company was set up in 1966 to fill special requirements of the Swiss instrument and watch industries by Philips (Netherlands), AG Brown, Boveri & Cie (Switzerland), Antophon AG (Switzerland), Landis & Gyr AG (Switzerland), and Zellwezer AG (Switzerland). It now employs 300 people and specializes in the production of linear type IC's and custom circuits. The company produces about 125 million transistors a year, four-fifths of which are manufactured in Zurich. About 10% of its production is reserved for Faselac's partners in Switzerland and the balance is absorbed by the Philips Group. Custom circuits produced have not exceeded runs of 100,000 units a year. The firm maintains modern diffusion, production, assembly, and testing facilities and plans to construct facilities for ion implantation in the near future.

Faselac's annual expenditures for new equipment fluctuate between $300,000 and $1 million. It usually amortizes such equipment over a 4-or-5 year period. Faselac usually buys from U.S. firms, particularly when requirements involve test/inspection equipment.

Switzerland's largest manufacturer of telecommunications equipment is Hasler AG of Bern. Founded in 1852, it produces telephone and telegraph equipment, radio and control instruments, industrial controls, data processors and cash registers. Its annual sales volume amounts to about $110 million, one-sixth of which is exported. It employs 7,000 people. It has developed several products, the most recent of which include: Computerized telex exchanges, traffic control systems, optical readers, solid-state telephone exchanges, remote controls, quartz clocks, and other sophisticated instruments. It is a traditional purveyor to the Government (PTT, radio stations, Military Department).

The company is headquartered in Bern, but maintains modern research and manufacturing facilities in Orbe. It employs multi-layer and thick film hybrid circuit techniques and recently acquired sophisticated PC production equipment with plotters. In Bevaix, Nenchatel, under the name of Favag, Hasler operates a small facility for the diffusion and production of digital/logic circuits and transistors using Fairchild "plenar" technology. Favag also produces reed relays in Nanchatel.

Competitive Environment

Domestic manufacture of EIPT equipment, whether used only by the manufacturer (in-house) or sold to other users, totaled $1.5 million in 1972. Local production is not expected to account for more than 10% of the country's requirements in the future.

EIPT equipment is manufactured to a limited extent by many of the medium-to-large Swiss companies. Much of the equipment used is custom-made or assembled from imported components.

Swiss electronics manufacturers look to the United States as a primary source of supply of advanced production and test equipment. The United States is expected to maintain its 40% percent share of the market at least through 1977, although increasing competition may be expected from other countries, especially Germany, France, the United Kingdom, and Italy. A growing percentage of imports of EIPT equipment to Switzerland is anticipated to originate from U.S. foreign subsidiaries.

Many U.S. manufacturers of EIPT equipment are represented in Switzerland. Some of the larger firms maintain subsidiaries which import from the United States or from manufacturing subsidiaries in other parts of Europe. However; they do not manufacture in Switzerland. Oxy Metal Finishing Co., for example, subcontracts the production of plating circuits equipment in Switzerland or neighboring countries.

Swiss end-users contemplating the purchase of foreign EIPT equipment usually prefer to deal with local representatives rather than directly with an overseas manufacturer. Of primary importance to the purchaser is the availability of spare parts. Price, in many cases, plays a secondary role.

U.S. exporters who wish to penetrate the Swiss EIPT equipment market are encouraged to disseminate technical literature, operation manuals and promotional brochures written in German and French. Participation in local exhibitions and fairs, as well as in relevant exhibitions in neighboring European countries, is recommended.

Technical Requirements

Switzerland uses the metric system of weights and measures. Where applicable, all equipment should be adapted to the above standard.

Electrical current is 50 hertz, 220 and 380 volts, single- or 3-phase. All electrical equipment operating from a power line must have prior approval from the S.E.V. (Schweiz Elektrotechnischer Verin), the Swiss electrical association, Seefeldstrasse 301, 8008 Zurich. Approval by the S.E.V. presents no problems for most equipment imported from the United States.

Additional information on Swiss technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

Table 1.—(Switzerland): Consumption of Electronic Industry Production and Test Equipment, 1971–1973.

(in millions of U.S. dollars)

	1971	1972	1973
Semiconductor and integrated circuit production equipment	2.3	2.5	2.8
Printed circuit production equipment	5.4	4.5	5.2
Wiring assembly and other interfacing equipment	1.7	2.0	2.3
Passive component and miscellaneous production equipment	.9	1.0	1.1
Test equipment for production/ inspection of electronic products	4.3	5.0	5.8
Total	14.6	15.0	17.2

Source: U.S. Department of Commerce, Bureau of International Commerce market research report.

Table 2.—(Switzerland): Imports of U.S. electronic industry production and test equipment, 1972, and projected 1974 and 1977.

(in millions of U.S. dollars)

	1972	1974	1977
Production equipment	2.85	3.95	5.01
Test equipment	3.15	3.48	3.94
Total	6.00	7.43	8.95

Source: U.S. Department of Commerce, Bureau of International Commerce market research report.

Taiwan

Electronics, primarily the manufacture of consumer electronics and components, is one of the fastest growing industries in Taiwan. Production in this industry increased 90% from 1971 to 1972, and this expansive trend is expected to continue at least over the next several years.

It follows that increasing suppliers of electronics industry production and test (EIPT) equipment will be needed to supply the requirements of the growing electronics industry. The market for EIPT equipment in Taiwan is expected to increase from $9.3 million in 1972 to $45.0 million in 1977, an average annual growth rate of 76%. The market for passive component and semiconductor production equipment shows an excellent sales potential for U.S. firms as the industry changes its emphasis from assembly operations to the production of components.

The EIPT equipment market in Taiwan is supplied almost entirely by imports, of which Japan accounts for approximately 50%. The current U.S. share is roughly 35%, but a government policy favoring imports of industrial equipment from the U.S. should assist American suppliers in increasing their share of the market.

Selected Sales Opportunities

The EIPT equipment market in Taiwan, which totalled $5.1 million in 1971, was expected to expand to $15 million in 1973. Test equipment for production/inspection of electronics products accounted for 40% of the total market in 1972. Test equipment and wiring assembly and other interfacing equipment have been in great demand during the early 1970's, when the main thrust of Taiwan's electronics industry has been toward TV and transistor radio assembly operations.

More recently, a large market has developed for components, for both domestic sale and for export. Production of electronic components in Taiwan increased 125% in the first quarter of 1973 over the same period in 1972 and significant growth is expected to continue at least through 1976.

With this shifting emphasis in the domestic electronics industry, demand for passive component, semiconductor and integrated circuit production equipment is expected to increase significantly and could represent 40% of the total EIPT equipment market of $45 million in 1977.

A recent survey conducted by the American Embassy in Taiwan indicated that the following equipment will have maximum sales potential for U.S. suppliers:

Semiconductor and integrated circuit production equipment
- Dicing machines
- Thermocompression and ultrasonic bonders

Wiring assembly and other interfacing equipment
- Point-to-point wiring equipment
- Crimping machines
- Cutters
- Terminal installing machines
- Connector assembly machines

Passive component and miscellaneous production equipment
- Molding presses
- Metal forming machines
- Labeling machines
- Embossing machines

Test equipment for production/inspection of electronic products
- Integrated circuit test equipment
- Transistor test equipment
- Diode test and classifier equipment
- Printed circuit board testers
- Digital systems analyzers
- X-ray inspection equipment

The Electronics Industry

Taiwan's domestic electronics industry is dominated by American, Japanese, and European multinational companies. There are an estimated 370 electronic plants operating in Taiwan, 110 of which are foreign-owned or joint venture firms.

The largest individual enterprise from the standpoint of invested capital is Philips Taiwan, which produces discrete components and TV picture tubes. The largest firm by number of employees is the U.S. General Instrument Corporation, which manufactures components for consumer electronic and industrial use.

Other major U.S. firms operating in Taiwan include: RCA, in TV assembly and component production; Admiral and Zenith, in TV production; Philco-Ford, in consumer products; TRW, in components; and Texas Instruments, in integrated circuits.

Production in the consumer electronics sector has been concentrated in TV assembly operations, mainly black and white small screen sets, and in transistor radios. The number of TV sets assembled on Taiwan in 1972 was 3.6 million, and production levels for 1973 were estimated to reach 4.1 million sets. Industry officials expect production to level at around 4.5 million sets per year by 1975. Production of portable color TV sets is expected to become increasingly important and may surpass the 1 million mark in 1 to 2 years.

Transistor radio production should total over 8 million sets in 1973, up 33% from the 6 million assembled in 1972.

Another consumer item experiencing rapid growth in production is tape recorders. Production doubled to nearly 800,000 in 1972 and was expected to reach 1.2 million in 1973.

Taiwan has a sizable components industry, with production centered on CRT's, semiconductors, resistors and capacitors. Component production (not including capacitors), totaled approximately $155 million in value in 1972. It reached an estimated $300 million in 1973, and is expected to total over $500 million by 1975.

Production in industrial electronics is small. However, strong growth for telecommunications equipment is a distinct possibility, with both ITT and General Telephone considering the establishment of facilities on Taiwan.

Taiwan's electronics industry has grown from a series of small-scale assembly operations to an undertaking which has reached a high level of sophistication. Production facilities for CRT tubes are probably among the best in the world, while many component and TV plants employ the most modern equipment and assembly line techniques. More and more advanced operations are being introduced by the multinational investors, and within a few years Taiwan should rank on a level close to the United States, Japan, and Western Europe in electronic production facilities and technology. The primary weakness in the industry has been the need to import technology but this deficiency is gradually being remedied.

Continued expansion is predicted for all sectors of the Taiwan electronics industry. Major companies undertaking or planning large-scale expansion at this time include Admiral, Sanyo, Texas Instruments, Pacific Electric Wire and Cable and TDK. The Taiwan Government is encouraging further growth in production of components such as semiconductors, integrated circuits, transistors, ferrite cores and magnetic tape recording heads, as well as more advanced products such as calculators, digital computing scales, testing and measuring instruments and computer peripherals and terminals. Incentives include either a five-year income tax "holiday" or accelerated depreciation, plus a maximum income tax rate of 18%. An increasingly well trained and hard working labor force and the external economies of scale brought about by the rapid development of this industry are further attractions for new investors in Taiwan's electronics industry.

Competitive Environment

There is practically no domestic manufacture of EIPT equipment in Taiwan, therefore the market must be supplied almost entirely by imports. The United States held approximately 35% of the $9.3 million market in 1972, while Japan controlled over 50%. The rest of the market was filled by European sources, primarily West Germany and the Netherlands. An aggressive campaign on the part of U.S. manufacturers could win them a larger share of the market.

There are no major non-tariff barriers to the importation of EIPT equipment. Government efforts to diversify sources of supply for imported capital goods from Japan to other sources, especially U.S. and Western European, should be beneficial to U.S. exporters.

American exporters, however, will have to demonstrate both aggressiveness and flexibility to meet the demands of the local market. Service facilities, quick availability and high quality are as important as price for customers who include many of the largest and best-known names in the international electronic industry.

Suppliers would benefit by providing local agents with an inventory of major items most in demand to meet customer needs promptly. Flexible credit terms are also important.

Yugoslavia

A 10% average annual growth rate is projected for electronics production in Yugoslavia over the next several years, with an intensification in capital outlays expected to occur in the industry starting in 1974. The country's market for electronics industry production and test (EIPT) equipment is expected to grow accordingly. Trade sources predict that Yugoslavia's buyers will continue to rely on imports, particularly from the United States, for most of their equipment needs.

Selected Sales Opportunities

Research recently conducted in Yugoslavia for the U.S. Department of Commerce, Office of International Marketing, reveals favorable export opportunities for American manufacturers of the following products:

- Printed circuit cameras
- Cleaning and drying equipment
- Artwork and pattern generation equipment
- Etching and drilling machines
- Protective coating equipment
- Soldering equipment
- Photoresist stripping machines
- Cutters
- Strippers
- Cable harness equipment
- Component test equipment

The Electronics Industry

Yugoslavia's electronics industry consists primarily of six major firms. Together, they accounted for 90% of the industry's total production—valued at $230 million—in 1972. The three largest companies are Iskra, Elektronska Industrija (EI), and Nikola Tesla Tvornica. Rudi Cajavecza, Radio Industrija Zagreb, and Gorrenje are smaller enterprises, each with annual sales below $10 million.

Iskra ZP, founded in 1946 with 852 employees, is now one of the largest industrial organizations in Yugoslavia. Its 1971 workforce totaled 17,000 employees, a 6.7% increase over the previous year. Of this number, 14,500 were engaged in production, 800 worked in the Research and Development Institute, and 1,600 were employed at Iskra Commerce, a special marketing group. Iskra offers a highly diversified line of 5,000 products, including telecommunications equipment, passive components, radio and television receivers, and many electrical items.

One of the most important reasons for the company's progress is its emphasis on research. The total 1971 budget for research and development, for example, was about $3 million, a 20% increase over the previous year. Iskra's Research and Development Institute is engaged in a variety of projects and works closely with such academic institutions as the School of Electrical Engineering of Ljubljana University.

In addition to the Research and Development Institute, the Iskra group includes the Automated Data Processing Center and Iskra Commerce. Iskra Commerce is responsible for product and sales planning and cooperative and investment agreements, as well as sales promotion. Exports exceeded $17 million in 1970, a 400% jump over 1965, and approached $20 million in 1971. This company is one of the largest commercial bodies in Yugoslavia. Its Domestic Sales Division includes 14 branch offices, 16 service centers, and several hundred contract service shops located throughout the country.

The company's foreign business is conducted through the International Division of Iskra Commerce, and it has increasingly directed its efforts to foreign markets. The company is represented in Italy, West Germany, Great Britain, the United States, Venezuela, the U.S.S.R., Czechoslovakia, Turkey, and Poland.

Iskra is organized into five major product groups: Telecommunications, automation, components, electromechanical parts and devices, and consumer goods. The telecommunications division employed approximately 4,000 workers in 1971. It plans, installs, and maintains public and private telephone exchanges. It manufactures telephone exchange equipment, carrier frequency equipment, facsimile apparatus, and telephone sets. In addition, it produces line coupling equipment, relays, electronic switching devices and other components.

The automation division's 1,100 employees are engaged in fabricating such products as highway and railway signaling equipment and traffic control equipment, components and devices, as well as relays and other components for the protection and automatic operation of generators, transformers, and power transmission networks. This division modernized the country's main railway lines during 1971, providing signaling equipment, selective telephone calling systems, and remote control installations.

Three of Iskra's major manufacturing divisions were involved in the production of components in

1971. Selenium rectifiers, silicon semiconductors, ceramic capacitors, thermistors, and other components were fabricated. Part of this output is exported, and the firm hopes to increase worldwide sales of components.

The division specializing in electromechanical parts and devices employed 4,700 people in 1971. They produce a broad range of products, including electrical parts for motor vehicles, electric motors, capacitors, watt-hour meters, and electrical energy meters. They also manufacture electronic measuring equipment for medical use, thermal controls, industrial contactors, switches, and other products.

The company had more than 1,800 people engaged in the manufacture of consumer goods in 1971. Television receivers, voltage stabilizers and antennas, radio receivers, home appliances, and hand tools were among the products fabricated.

Iskra maintains close relations with a number of domestic and foreign concerns. Its affiliations with Braun A/G, Hoover, Ltd., and British Radio Corporation, Ltd., for example, have been beneficial in the consumer products field. The firm is also associated with the Yugoslav postal, telephone, telegraph, and postal services, as well as all railroads. It maintains agreements with such U.S. firms as Control Data Corporation, Bell Telephone, ITT, and General Electric, and with a number of Western European companies.

Elektronska Industrija, Yugoslavia's second largest electronics firm, was formed in 1962 as a result of a merger of several electronics companies, the largest of which was the Belgrade Electronic Industry Belind. Medical Instruments Factory Sutjeska and Fabricated Metal Products Milan Blagojevic were amalgamated with EI in 1969. The firm now employs over 24,000 workers, compared to 13,639 in 1963, and has about 35 plants. The value of its production was estimated at $150 million in 1971—a 300% increase over the 1965 level—and capital investments are reported to be between $1 and $2 million.

About 79% of the company's output is sold domestically, and the remainder is exported. The majority of EI's domestic sales are handled by independent trading houses, rather than by firm-owned outlets. Exports, on the contrary, are conducted mostly through the firm's own international division. Major export items include vacuum tubes, semiconductors, and capacitors.

EI's highly diversified product line includes power transformers, radio and television receivers, telephone and other transmitting apparatus, electron tubes, semi-conductors, X-ray tubes and apparatus, condensers, ferrites, and electrical medical equipment. In addition, the firm manufactures a broad range of home appliances.

EI's manufacturing generally utilizes modern production methods. Consumer products, which account for 40.3% of the company's total output, are usually fabricated in large series. Professional and electric medical devices are handled as medium-serial or job-lot production. Professional electronic equipment accounts for 15.7% of total production by value; the Machine Parts Manufacturing Group, 10.3%; Assembly Elements, 8.6%; Electric Medical Equipment, 4%; and other activities, about 21%.

The firm turns out some 70% of the country's television sets, 85% of the radios, 37% of the kitchen ranges, and nearly all of the electric and other medical appliances. About 40% of the Yugoslav professional electronic and telecommunications equipment and 100% of the electron tube production are supplied by EI. While the company produces its own semiconductors, MSI components are imported. EI maintains close relations with Siemens of West Germany.

Gorrenje, one of the smaller electronics firms, mainly produces consumer products. In 1971, it began manufacturing stereo radios and black and white and color televisions. By 1974, Gorrenje plans to have its own printed circuit production. The firm is affiliated with Korting in the fabrication of color TV receivers.

Industry Forecasts Optimistic

The anticipated relaxation in Yugoslavian currency conversion practices should ease many of the problems that have previously limited the industry's growth. Investments, purchases of raw materials, and licensing arrangements also will be facilitated.

Production of professional electronic goods will rise appreciably over the next few years and, by sometime in 1974, new expansion plans for manufacturing plants will be formulated. About 80% of the industry's total 1971 output consisted of consumer goods and 20% of professional products. It is forecast that by 1975 this ratio will shift to 60% and 40% for consumer and professional products, respectively.

Yugoslav production of semiconductors, valued at $4 million in 1971 and estimated at $5.5 million in 1973, should reach $6 million in 1975. This corresponds to a rise in output from 10 million units in 1971 to 13 million in 1975.

Production of monochrome television receivers is expected to decline slightly, due to the increasing popularity of color TV. The value of black and white television receiver output in 1975 should be around $33 million, or 300,000 units, down from $34.9 million, or 317,000 units, in 1971. A surge in the production of color receivers is predicted, with output projected to rise from 3,000 units in 1971 to 25,000 units in 1975. There were 236,000 radio receivers manufactured in 1971, a slight decline from the 240,000 produced in 1967.

Government Spurs Production

The Yugoslav Government has announced a $600-million program to improve the country's general economy. Firms in high technology areas, including some electronics companies, are expected to benefit from this new program. There also is a 10-year Government program, involving an estimated $400-million investment, to improve the nation's telecommunications.

Nine institutes conduct research in electronics, telecommunications, and automation. They are: Mihailo Pupin Institute (Belgrade); Rade Koncar Electrical Engineering (Zagreb); Institute of Electronics and Vacuum Techniques (Ljubljana); RIZ Institute (Zagreb); Energoinvest Research and Development Center (Sarajevo); Iskra Institute of Automation (Ljubljana); Boris Kidric Institute (Zagreb); Rudjer Boskovic Institute (Zagreb); and Jozef Stefan Institute (Ljubljana). Major areas of research are electronic data processing, electronic telephone systems, multichannel telephony, teleprinting, and railway signaling systems. Close cooperation exists between the nine institutes and electronics firms in the promotion and development of the production of elements, apparatus, and installations.

Trade Factors

Import duties range between 10 and 15% on EIPT equipment. Terms for the financing of high-value imports may vary from 3 to 6 years. Additional information on exporting to Yugoslavia may be obtained from the Office of International Marketing Bureau of International Commerce, U.S. Department of Commerce, Washington, D.C. 20230.

Technical Requirements

Electrical characteristics in Yugoslavia are 50 hertz, 200 volts, single phase, or 380 volts, 3-phase. The metric system of weights and measures is used. Further information on matters of technical standards may be obtained from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

Supplementary Information for U.S. Exporters

EXPORT INFORMATION SERVICES

The U.S. Department of Commerce provides a wide range of information services to assist business firms in their export activities. Recently modernized handling techniques have substantially reduced the length of time required to procure the information for the businessman.

The information services listed below can be obtained by contacting the nearest U.S. Department of Commerce district office or by writing directly to the Export Information Division/OED/DIBA/266, U.S. Department of Commerce, Washington, D.C. 20230.

World Traders Data Reports

World Traders Data Reports (WTDR's), formerly known as World Trade Directory Reports, provide descriptive background information on specific foreign firms. Prepared by the U.S. Foreign Service, the WTDR's include such information as year of establishment, method of operation, lines handled, size of sales territory, name of chief executive, general reputation in trade and financial circles, names and addresses of credit sources, names of the firm's connections, and other commercial information. The complete name, street and city address of the foreign firm must be given when requesting this service. The price is $15 per report.

Agent/Distributor Service

The Agent/Distributor Service (ADS) is designed for the businessman who needs assistance in identifying potential foreign agents or distributors. The information, which is provided by the U.S. Foreign Service, consists of up to three names of such prospects. Up to 30 days are required from date of receipt to complete the request. The charge for this service is $25.

Trade Opportunities

Trade Opportunities (TO's) are inquiries by overseas companies expressing interest in purchasing U.S. products and services or in representing U.S. firms. They can come from private commercial services, foreign governments, or multinational organizations such as the United Nations and NATO.

Over 12,000 TO's are received each year by telex from U.S. Foreign Service posts around the world. In Washington they are computer-matched to the specifications of subscribing U.S. suppliers, who are then notified of appropriate inquiries by mail—all within one week of a TO's origination overseas. Subscribers specify their product, country, and type-of-opportunity interests and pay for the TO's, priced at 50 cents each, in advance. Subscriptions of $25, $50 and $125 are available. Firms wishing to receive TO's on a regular basis should contact their nearest Commerce Department district office for further details.

Export Mailing List Service

The Export Mailing List Service (EMLS) provides lists of foreign firms considered suitable for export contact purposes. Firms are drawn from the automated Foreign Traders Index. Their names and addresses are available on gummed mailing labels or in standard printout format. Printouts also include: name and title of an officer, type of organization, year of establishment, relative size, number of employees and salespersons, and product and/or service codes (Standard Industrial Classification numbers). A basic "set-up" payment of $15, applicable to each retrieval, must accompany each request.

This charge covers payment for up to 300 printed names. An additional 5 cents is charged for each name above 300. Delivery can be made in about 15 days.

FTI Tape Service

This service is offered as a convenience to firms that have a continuing need for a broad range of foreign commercial data, such as export management firms selling a wide range of products. This service provides, in magnetic tape form, information on all firms in one or more countries covered in the Foreign Traders Index. Users may thus retrieve various segments of FTI data by running tapes through their own computer facilities. The charge for this service is $177.50 per country, up to 15 countries. The costs of the data for 15 or more countries or for the entire file is $2,500.

Other Services

Business counseling services are provided both at the U.S. Department of Commerce in Washington and at the Department's 43 district offices (see *Commerce Contacts for U.S. Business* section of this Survey for full listing). Visitors to Washington are served by the Business Counseling Section, which provides in-depth counseling and schedules appointments with appropriate officials within the Domestic and International Business Administration as well as with officials in other agencies.

FINANCING EXPORT SALES

The Export-Import Bank of the United States

The Export-Import Bank of the United States (Eximbank) is an independent agency of the U.S. Government which works directly with American suppliers and private financial institutions to finance U.S. export sales. Eximbank has over 20 financing programs to assist U.S. firms. These include direct loans, bank guarantees, discount facilities, leasing guarantees, and other programs to cover overseas design and engineering studies, construction operations, licensing technology, and agricultural export financing.

Financing packages for major industrial projects and exports of high value products are normally supported under Participation Financing, a combination of the Direct Loan and Financial Guarantee programs.

Direct Loans are dollar credits extended by Eximbank to borrowers outside of the United States for purchases of U.S. goods and services. Disbursements under the loan agreement are made in the United States to the suppliers of the goods and services, and the loans, plus interest, are repaid in dollars by the borrowers.

Eximbank will extend its Financial Guarantee to cover loans made by U.S. financial institutions to foreign government or private purchasers of U.S. goods and services. The Financial Guarantee will unconditionally guarantee repayment by a borrower of up to 100% of the outstanding principal due on such loans plus interest equal to the U.S. Treasury rate for similar maturities, plus 1% per annum on the outstanding balances of the loan. Comparable guarantees are available to non-U.S. financial institutions under somewhat different terms.

Participation by private financing institutions is required in any transaction seeking Eximbank direct lending. If requested by the private lender, Eximbank may extend its Financial Guarantee to assure repayment of the private party's portion of the total financing. Eximbank will often allow repayment of the private lender's portion of the loan first, which normally carries a higher rate of interest, thereby reducing the effective interest cost to the borrower.

Of particular importance to U.S. businessmen is Eximbank's Cooperative Financing Facility program which supports medium-term financing in all major markets. Eligible overseas banks are extended a line of credit for half the funds needed for each transaction, presently at 7% interest, and the cooperating banks provide the other half at local market rates. These banks make credit judgments regarding the customer and can consummate transactions with a minimum of difficulty. Eximbank currently has established nearly 300 such working arrangements with foreign financial institutions (private and public) in over 100 countries.

Eximbank's Commercial Bank Exporter Guarantee program, another activity of special interest to exporters, provides guarantees covering the credit and political risks of non-payment of medium-term (181 days to 5 years) export debt obligations purchased by U.S. banking institutions on a non-recourse basis from the exporters. The fee charged for Eximbank's guarantee depends upon (1) the classification accorded the country of import, (2) the length of the repayment terms, and (3) the financial condition of the overseas buyer.

As a general rule, all transactions supported by Eximbank must include a 10% cash payment by the buyer and must have reasonable assurance of repayment.

The Bank is directed by statute to supplement and encourage private capital, not compete with it. Selected product lines and services to designated markets are excluded from the agency's support; however, the overwhelming majority of U.S. export products and markets are covered. Details on the exceptions are available from U.S. commercial banks or directly from Eximbank.

Businessmen are specifically invited to utilize Eximbank's counseling services for exporters, banks and financial institutions seeking financing for U.S. exports. The services include information on the availability of financing within the United States and abroad, as well as on each of the pertinent Eximbank programs.

For additional information, contact the Export-Import Bank of the United States, 811 Vermont Avenue, N.W., Washington, D.C. 20571, or Telex 89-461.

EXPORT CREDIT INSURANCE

The Foreign Credit Insurance Association (FCIA)

The Foreign Credit Insurance Association (FCIA) is an association of 50 stock and mutual insurance companies in partnership with the Export-Import Bank of the United States. It offers a comprehensive selection of credit insurance policies which protect policyholders against loss from failure to receive payment from foreign buyers.

The benefits of this coverage may be summed up as follows:

- It protects the exporter against the failure of the buyer to pay his dollar obligation for commercial or political reasons,
- It enables the exporter to offer foreign buyers competitive terms of payment,
- It supports the exporter's prudent penetration of higher risk foreign markets,
- It gives the exporter greater financial liquidity and flexibility in administering his foreign receivables portfolio.

Who May Be Insured

Virtually any corporation, partnership, or individual doing business in the United States is eligible for FCIA coverage. An exporter may apply for a policy for himself or may become insured under the blanket policy of a bank or other financial institution which holds an FCIA policy.

Eligible Products

Foreign sales of all types of industrial, agricultural, and commercial products produced in the United States and of services rendered by U.S.-based personnel are eligible for FCIA insurance.

What Losses Are Covered

Comprehensive FCIA policies protect insureds against non-payment of receivables due to unforseeable commercial and political occurrences. Commercial risks which are covered include insolvency of the buyer or protracted defaults which may well arise from economic deterioration in the buyer's market area, shifts in demand, unanticipated competition, tariffs, or technological changes. Also covered are defaults due to such buyer problems as increasing expenses, the loss of key personnel, and natural disasters.

Political risks coverage applies to defaults due to governmental action and to political disturbances such as war, revolution, and insurrection. Such events may result in confiscation of the buyer's assets, detention or diversion of shipments, or cancellation of necessary licenses by the United States or by the buyer's country. Also covered is the inability or refusal of the foreign central bank involved to convert the buyer's currency to dollars. Political coverage alone is available for exporters who desire to assume their own commercial risks.

The Policies

The policies offered by FCIA are many and varied. They can be tailored to suit the needs of the individual exporters, service groups, and financial institutions. Aside from a small application fee, all premiums are paid only for goods actually shipped.

The Master Policy combines a deductible provision, discretionary credit authority, and once-a-year reporting to provide qualified exporters with lower premiums, independent credit decisions, faster service to overseas buyers, and less paperwork. It is a blanket policy which requires the exporter to insure all or a reasonable spread of his exportation.

The Short-Term Policy is a blanket policy which covers sales on terms of up to 180 days. It provides coverage of 90% for commercial losses and 95% for political losses. A moderate discretionary credit limit is included for each buyer.

The Medium-Term Policy provides 90% coverage (political and commercial) for capital and quasi-capital goods sold on terms of 181 days to 5 years. The policy is written on a case-by-case basis so an exporter need not insure all his medium-term transactions as he would under a blanket policy.

The Combination Policy provides short- and medium-term insurance to protect U.S. exporters in transactions with overseas dealers and distributors. It includes flexible coverage for short-term sales and for both inventory and receivable financing.

The Global End-User Policy allows exporters to insure the sales of capital goods to end-users through overseas distributors, dealers, and subsidiaries. This program permits title of capital goods to be transferred from the dealer to the end-user and still be eligible for coverage ("on-going sale").

The Comprehensive Services Policy insures the receivables generated by the performance of services of U.S.-based personnel, or U.S. personnel temporarily assigned overseas, for foreign customers. Industries benefiting from this coverage also include management consultants, engineering and related construction consulting services, and transportation companies.

Special Policies: The FCIA also provides specially adapted policies for new exporters (the *Small Business Policy*) and for exhibitors in Department of Commerce Trade Shows (the *Exhibitors Policy*).

Special Coverage Endorsements are available for addition to the above policies. These include endorsements to cover specified preshipments risks and consignment selling.

An Aid to Financing

FCIA does not finance export sales. However, the exporter who insures his accounts receivable against commercial and political risks is usually able to obtain financing from commercial banks and other lending institutions at lower rates and on more liberal terms than would otherwise be possible.

Prequalification of Buyers

FCIA's rapidly expanding P.Q. program is now providing immediate credit information on over 25,000 overseas buyers through its computerization data system. All the exporter needs to do is to telephone the nearest FCIA office to determine whether a particular buyer is prequalified for the amount of his purchase.

Information about FCIA

More information about FCIA's services and applications for policies may be obtained through insurance agents or brokers or through FCIA's network of full-service regional offices. General questions and specific inquiries may be directed toward the FCIA Ombudsman in our New York office. Call (212) 432-6216 for a direct connection.

FCIA Offices

One World Trade Center—9th Floor
New York, New York 10048
Phone: (212) 432-6200

Suite 1003—William-Oliver Bldg.
32 Peachtree Street, N.W.
Atlanta, Georgia 30303

Suite 1552
10 South Riverside Plaza
Chicago, Illinois 60606

Suite 1435
55 Public Square
Cleveland, Ohio 44113

611 West Sixth Street
Suite 650
Los Angeles, California 90017

700 North Water Street
Suite 1110—First Federal Bldg.
Milwaukee, Wisconsin 53202

1006 Main Street
C & I Bldg.—Suite 1408
Houston, Texas 77002

1 Embarcadero Center
Suite 2212
San Francisco, California 94111

Woodward Bldg., Suite 539
15th & H Streets, N.W.
Washington, D.C. 20005

TAX BENEFIT PROGRAM FOR U.S. EXPORTERS (DISC)

Exporters will want to become familiar with the provisions of the Revenue Act of 1971 (Public Law 92-178) which permit U.S. firms to establish Domestic International Sales Corporations (DISC's) entitled to a tax break on export income. Essentially, the DISC is a domestic corporation which meets certain minimal organizational requirements and limits itself almost exclusively to export sales activities. If the corporation derives at least 95% of its income from export sale, lease, or rental transactions, and 95% of its assets are export related, it can defer U.S. income tax on up to 50% of its export income. Tax-deferred retained earnings can be used to expand and promote the DISC's export business and may also be loaned to any domestic producer of export goods, including the DISC's parent company.

DISC's can be formed by manufacturers, nonmanufacturers, and export groups. A DISC can function as a principal, buying and selling for its own account, or as a commission agent. It can be related to a manufacturing parent or can be an independent merchant or broker. Special intercompany pricing rules on transactions between a DISC and a related supplier or manufacturer allow a larger profit to the DISC than would normally be the case under the usual arm's length pricing requirements of the Tax Code.

A corporation wishing to be treated as a DISC must file a statement of election (IRS Form 4876) with the Internal Revenue Service within 90 days preceding the beginning of its tax year, for a corporation already in existence, or within 90 days after the date of incorporation, if newly formed.

The rules for organizing and operating a DISC are comparatively simple. Many U.S. businesses, both large and small, should be able to avail themselves of the advantages of exporting through DISC's.

For information, write Foreign Business Practices Division, Domestic and International Business Administration, U.S. Department of Commerce, Washington, D.C. 20230, or phone (202) 967-4471.

COMMERCE CONTACTS FOR U.S. BUSINESS

Office of Field Operations

The 43 U.S. Department of Commerce district offices listed below represent the Department in their respective localities and assist in carrying out the programs of the Department. Under the direction of the Office of Field Operations, these district offices are staffed by experienced specialists prepared to help in the solution of business problems and assist in exporting.

ALBUQUERQUE, NEW MEXICO 87101
U.S. Courthouse—Room 316
Area Code 505 Tel. 766-2386

ANCHORAGE, ALASKA 99501
412 Hill Building
632 Sixth Avenue
Area Code 907 Tel. 265-4597/8

ATLANTA, GEORGIA 30309
Suite 523, 1401 Peachtree St., N.E.
Area Code 404 Tel. 526-6000

BALTIMORE, MARYLAND 21202
415 U.S. Customhouse
Gay and Lombard Streets
Area Code 301 Tel. 962-3560

BIRMINGHAM, ALABAMA 35205
Suite 200-201
908 South 20th Street
Area Code 205 Tel. 325-3327

BOSTON, MASSACHUSETTS 02116
10th Floor, 441 Stuart Street
Area Code 617 Tel. 223-2312

BUFFALO, NEW YORK 14202
910 Federal Building
111 West Huron Street
Area Code 716 Tel. 842-3208

CHARLESTON, SOUTH CAROLINA 29403
Federal Building, Suite 631
334 Meeting Street
Area Code 803 Tel. 577-4171, Ext. 361

CHARLESTON, WEST VIRGINIA 25301
3000 New Federal Office Building
500 Quarrier Street
Area Code 304 Tel. 343-6181, Ext. 375

CHEYENNE, WYOMING 82001
6022 O'Mahoney Federal Center
2120 Capitol Avenue
Area Code 307 Tel. 778-2220, Ext. 2151

CHICAGO, ILLINOIS 60603
Room 1406
Mid-Continental Plaza Bldg.
55 E. Monroe Street
Area Code 312 Tel. 353-4450

CINCINNATI, OHIO 45202
8028 Federal Office Building
550 Main Street
Area Code 513 Tel. 684-2944

CLEVELAND, OHIO 44114
Room 600, 666 Euclid Avenue
Area Code 216 Tel. 522-4750

DALLAS, TEXAS 75202
Room 3E7, 1100 Commerce Street
Area Code 214 Tel. 749-1515

DENVER, COLORADO 80202
Room 161, New Customhouse
19th and Stout Streets
Area Code 303 Tel. 837-3246

DES MOINES, IOWA 50309
609 Federal Building
210 Walnut Street
Area Code 515 Tel. 284-4222

DETROIT, MICHIGAN 48226
445 Federal Building
Area Code 313 Tel. 226-3650

GREENSBORO, NORTH CAROLINA 27402
203 Federal Building
West Market Street, P.O. Box 1950
Area Code 919 Tel. 275-9111, Ext. 345

HARTFORD, CONNECTICUT 06103
Room 610-B, Federal Office Building
450 Main Street
Area Code 203 Tel. 244-3530

HONOLULU, HAWAII 96813
286 Alexander Young Building
1015 Bishop Street
Area Code 808 Tel. 546-8694

JACKSONVILLE, FLORIDA 32207
Suite 129
4080 Woodcock Drive
Area Code 904 Tel. 791-2796

KANSAS CITY, MISSOURI 64106
Room 1840, 601 East 12th Street
Area Code 816 Tel. 374-3142

LOS ANGELES, CALIFORNIA 90024
11201 Federal Building
11000 Wilshire Blvd.
Area Code 213 Tel. 824-7591

MEMPHIS, TENNESSEE 38103
Room 710, 147 Jefferson Avenue
Area Code 901 Tel. 534-3214/5

MIAMI, FLORIDA 33130
Room 821, City National Bank Building
Area Code 305 Tel. 350-5267

MILWAUKEE, WISCONSIN 53203
Straus Building
238 West Wisconsin Avenue
Area Code 414 Tel. 224-3473

MINNEAPOLIS, MINNESOTA 55401
306 Federal Building
110 South Fourth Street
Area Code 612 Tel. 725-2133

NEWARK, NEW JERSEY 07102
Gateway Building (4th Floor)
Area Code 201 Tel. 645-6214

NEW ORLEANS, LOUISIANA 70130
909 Federal Office Building, South
610 South Street
Area Code 504 Tel. 527-6546

NEW YORK, NEW YORK 10007
41st Floor, Federal Office Building
26 Federal Plaza, Foley Square
Area Code 212 Tel. 264-0634

PHILADELPHIA, PENNSYLVANIA 19106
10112 Federal Building
600 Arch Street
Area Code 215 Tel. 597-2850

PHOENIX, ARIZONA 85004
508 Greater Arizona Savings Bldg.
112 North Central Ave.
Area Code 602 Tel. 261-3285

PITTSBURGH, PENNSYLVANIA 15222
431 Federal Building
1000 Liberty Avenue
Area Code 412 Tel. 644-2850

PORTLAND, OREGON 97205
Suite 501, Pittock Block
921 S.W. Washington Street
Area Code 503 Tel. 221-3001
RENO, NEVADA 89502
2028 Federal Building
300 Booth Street
Area Code 702 Tel. 784-5203

RICHMOND, VIRGINIA 23240
8010 Federal Building
400 North 8th Street
Area Code 703 Tel. 782-2246

ST. LOUIS, MISSOURI 63103
2511 Federal Building
1520 Market Street
Area Code 314 Tel. 622-4243

SALT LAKE CITY, UTAH 84138
1203 Federal Building
125 South State Street
Area Code 801 Tel. 524-5116

SAN FRANCISCO, CALIFORNIA 94102
Federal Building, Box 36013
450 Golden Gate Avenue
Area Code 415 Tel. 556-5860

SAN JUAN, PUERTO RICO 00902
Room 100, Post Office Building
Phone: 723-4640

SAVANNAH, GEORGIA 31402
235 U.S. Courthouse & Post Office Building
125-29 Bull Street
Area Code 912 Tel. 232-4321, Ext. 204

SEATTLE, WASHINGTON 98109
Room 706, Lake Union Bldg.
Area Code 206 Tel. 442-5615

U.S. Trade Centers Abroad

U.S. Trade Centers abroad provide U.S. manufacturers with a unique method of testing and selling in key foreign markets through commercial showrooms permanently established in central marketing areas where the potential for American products is continuous. The Trade Center in Warsaw, however, does not have exhibit facilities.

Beirut, c/o American Embassy Corniche at Rue Ain Mreisseh, Beirut, Lebanon.

Buenos Aires, Avenida Quintana No. 411, Buenos Aires, Argentina.

Frankfurt, Bockenheimer Landstrasse 2-4, Frankfurt am Main, Germany, Tel. 72-08-01.

London, 57 St. James Street, London, S.W.1, England, Tel. Hyde Park 5921.

Mexico City, 31 Liverpool, Mexico, D.F.5, Mexico, Tel. 528-5602.

Milan, Via Gattamelata 5, 20149, Milan, Italy, Tel. 46-95-451.

Osaka, American Merchandise Display, c/o American Consulate General, Sankei Kaikan Bldg., 9th fl., 27 Umeda-cho, Kita-ku, Osaka, 530, Japan.

Paris, 123 Avenue Charles de Gaulle, 92 Neuilly, Paris, France, Tel. 624-33-13.

Seoul, c/o American Embassy, 82 Sejong Rd., Seoul, Korea 110, Tel. 72-2601/9.

Singapore, c/o American Embassy, 30 Hill Street (FPO San Francisco 96699).

Stockholm, Vasagatan, 11, Stockholm C. Sweden, Tel. 08/24-84-20.

Sydney, 37 Pitt Street, Sydney, NSW, 2000, Australia, Tel. 241-1031.

Taipei, Taiwan Glass Bldg., 261 Nanking East Rd., Sec. 3, Taipei, Taiwan.

Tokyo, Tameike Hokyu Building, 1-14 Akasaka, 1-Chrome, Minato-ku, Tokyo, Tel. 583-7141.

Vienna, (East-West Trade Center) 8-10 Prinz Eugenstrasse, Vienna, Austria.

Warsaw, Trade Development Center, ul. Wiejska 20, Warsaw, Poland, Tel. 21-45-15/6.

Office of Export Administration

Information on U.S. export controls may be obtained from Exporters Service Branch, Office of Export Administration, Bureau of East-West Trade, U.S. Department of Commerce, Washington, D.C. 20230. Telephone: (202) 967-4811.

Schedule of Events

Schedule of Promotional Events for Global Market Survey Electronics Industry Production and Test Equipment

The schedule of promotional events for 1974 and 1975 is intended to assist firms in developing individual global marketing plans by selecting the most appropriate activities for promoting their products in 24 foreign countries covered in this Survey.

The Schedule provides a chronological listing, by country, covering the following types of promotional activities:

- **International Trade Fairs**—Privately sponsored, foreign managed international exhibitions in which U.S. firms may exhibit their products on an individual basis.
- **Conferences, Congresses, Seminars and Symposia**—Privately sponsored, international activities in which U.S. firms may participate on an individual basis. Some of these events are held in conjunction with international trade fairs; others are held independently.
- **U.S. Trade Center Shows**—U.S. Trade Centers, which provide year-round facilities for display and demonstration of U.S. products.

Some of these promotional events feature general EIPT and related equipment while others are oriented primarily to a specific end-user industry. The information for scheduled events was obtained from market surveys and the U.S. Foreign Service. Events are arranged chronologically by country. Some may be subject to change without notice, but at the time of publication were scheduled for the dates and locations shown unless listed as "(Proposed)".

Events sponsored by or participated in by the U.S. Department of Commerce appear in boldface letters on the Schedule. Additional Commerce-sponsored activities may be scheduled from time to time.

The Bureau of International Commerce provides direct export promotion and marketing assistance to U.S. companies, employing a variety of professional promotional techniques.

- **Specialized Product Shows** and other marketing activities are held in permanent facilities situated in major business centers. U.S. Trade Centers are located in Beirut, Buenos Aires, Frankfurt, London, Mexico City, Milan, Osaka, Paris, Seoul, Singapore, Stockholm, Sydney, Taipei, Tehran, Tokyo, and Vienna. A Trade Development Center is located in Warsaw.
- **"Between Show Promotions"**—During periods between major shows, individual U.S. firms, or their authorized representatives, are encouraged to use the above facilities to stage one-company product promotions or sale seminars.
- **Specialized U.S. Trade Missions**—The U.S. Department of Commerce organizes and sponsors Trade Missions covering selected product themes based on available market research and Foreign Service recommendations, establishes the overseas itinerary, pays the Mission's operating expenses, and provides an Advance Officer and Mission Director.

For further information regarding Commerce events contact any one of the 43 Commerce district offices listed two pages back. Additional information on all other events may be obtained from the contact indicated in the Schedule of Events for the particular activity.

Schedule of Promotional Events—1974-1975

EVENT	1974	1975
AUSTRALIA		
ELECTRONIC COMMUNICATIONS SHOW Location: Melbourne Contact: Technical Exhibitions Pty. Ltd. Ste. 3 Victoria, Australia Frequency: Annual	April	April
AUSTRALIA'S INTERNATIONAL ENGINEERING EXHIBITION (AIEE); INSTRUMENTS, AUTOMATION & ELECTRONIC CONTROL EXHIBITION (IAECE) Location: R.A.S. Showgrounds, Sydney Sponsor: AIEE: The Metal Trades Industry Association of Australia. IAECE: Institute of Instrumentation & Control, Australia Frequency: Annual	September 23-28	September
NATIONAL RADIO AND ELECTRONICS ENGINEERING CONVENTION Location: Sydney Sponsor: Institution of Radio and Electronics Engineers, Australia Science House, 157 Gloucester St., Sydney, Australia N.S.W. 2000 Frequency: Biennial		August
BELGIUM		
INTERNEPCON/EUROPA '74 Location: Centre International Rogier, Brussels Sponsor: Mr. Milton Kiver, President, Industrial & Scientific Conference Management, or Charles E. Cohrs, General Manager 222 W. Adams St., Chicago, Ill. 60606 Frequency: Annual	May 28-30	
INDUSTRIAL ELECTRICAL FAIR (INDUSELEC) Location: Centre International Rogier, Brussels Contact: Secretary, Sogestee SPRL 14 Rue Duquesnoy, Brussels, Belgium 4 Frequency: Annual	November	November

EVENT	1974	1975
BELGIUM (continued)		
INSTRURAMA '75 Location: Centre International Rogier, Brussels Sponsor: Union des Impactateurs et Constructeurs d'Appareils Scientifiques, Medicaux et de Controle 203 Avenue Slegers, 1150 Brussels, Belgium Frequency: Triennial		April
INTERELECTRONIC SALON Location: Palais du Centenaire, Brussels Sponsor: Union Professionnelle des Fabricants et Importateur de Material Electronique (F.A.I.R.) 74 Avenue Moliere, 1180 Brussels, Belgium Frequency: Biennial		November
BRAZIL		
6TH BRAZILIAN ELECTRO-ELECTRONIC FAIR Location: Sao Paulo Sponsor: Alcantara Machado, Rua Basilio Machado, 60 Sao Paulo, Brazil Frequency: Annual	July 12-21	
BULGARIA		
PLOVDIV INTERNATIONAL FAIR Location: Plovdiv Sponsor: International Trade Fair 36 Georgi Dimitrov Blvd., Plovdiv, Bulgaria Frequency: Annual	September	September
FRANCE		
INTERNATIONAL ELECTRONIC COMPONENTS EXHIBITION Location: Parc des Expositions, Port de Versailles, 75015 Paris Sponsor: Federation Nationale des Industries Electronique, 14 Rue de Presles, 75015 Paris Frequency: Annual	April 1-6	April
ELECTRONICS PRODUCTION EQUIPMENT EXHIBIT Location: U.S. Trade Center, Paris		March
INTERNATIONAL MEASUREMENT CONTROL REGULATION AND AUTOMATION (MESUCORA) Location: Kenit Building, Paris Sponsor: Secretariat General, 20 Rue Capeaux 92 Pluteaux Paris, France Frequency: Biennial		April 1976

EVENT	1974	1975
GERMANY		
HANNOVER FAIR Location: Hannover Fairgrounds Sponsor: Deutsche Messe—und Ausstellungs—A.G. D-3000 Hannover, West Germany Hannover, West Germany Frequency: Annual	April 25 May 3	Spring
6TH INTERNATIONAL INSTRUMENTATION AND AUTOMATION CONGRESS AND EXHIBITION (INTERKAMA) Location: Fairgrounds, Dusseldorf Sponsor: Dusseldorfer Messegesellschaft MBH NOWEA 4 Dusseldorf 10 Dusseldorf, Germany Frequency: Triennial	October 10-16	
6TH INTERNATIONAL ELECTRONIC COMPONENTS EXHIBITION (ELECTRONICA '74) (6th International Congress "Micro-Electronics" held in conjunction with exhibition) Location: Fairgrounds (Messegelaende), Munich Sponsor: Exhibit Manager, (Muenchener Messe) Ausstellungsgesellschaft Theresienhoehe 13, D-8000, Munich, Germany Frequency: Annual	November 21-27	
HUNGARY		
BUDAPEST INTERNATIONAL SPRING FAIR Location: Budapest Sponsor & Contact: Hungexpo, Hungarian Foreign Trade Office for Fairs & Publicity 1441 Budapest 70, P.O.B. 44, Hungary Frequency: Annual	May 18-26	
INTERNATIONAL EXHIBITION OF ELECTRONICS IN INDUSTRY Location: Kobanya Fairgrounds, Budapest Sponsor & Contact: Hungexpo, Hungarian Foreign Trade Office for Fairs & Publication, 1449 Budapest 70, P.O.B. 44, Hungary Frequency: Annual	December 4-10	
AUTOMATION, HIGH POWER ELECTRONICS, MIKRONIKA FAIR Location: Budapest Contact: Mr. Gyorgy Reich, Podinform, Institute for Technical & Scientific Information of the Ministry of of Metallurgy, Budapest 5, P.O.B. 453 Frequency: Biennial		September or October

EVENT	1974	1975
INDIA		
ALL-INDIA ELECTRONICS CONFERENCE Location: Vigyan Bhawan, New Delhi Sponsor: Department of Electronics, Government of India Vigyan Bhawan Annex, New Delhi 11, India Frequency: Ad hoc		February-March
INDIA AND THE ELECTRONICS AGE Location: Exhibition Grounds, New Delhi Sponsor: All-India Radio & Electronics Association Daryagani, Delhi 6, India Electronic Components Industries Association C-40 NDSE 11, New Delhi 49, India Frequency: First time	December-January	
ISRAEL		
9TH CONVENTION OF ELECTRICAL & ELECTRONICS ENGINEERS IN ISRAEL (IEEE) (Includes a Symposium) Location: Exhibition Gardens, Tel Aviv Sponsor: Institute of Electrical & Electronics Engineers (Israeli Chapter) P.O. Box 2923, Tel Aviv, Israel Frequency: Biennial		April
ITALY		
INTERNATIONAL ELECTRONIC COMPONENTS, MEASURING INSTRUMENTS, ACCESSORIES EXHIBITION Location: Milan Sponsor: Exhibit Manager Via L. Manara 1 Milan, Italy Frequency: Annual	May	
INTERNATIONAL AUTOMATION & INSTRUMENTATION EXHIBITION AND CONFERENCE Location: Milan Fairground Sponsor: Secretary, Associazioni Scientifiche & Techniche P le Morandi 2, Milan, Italy Frequency: Biennial	November 13-19	
JAPAN		
INTERNEPCON/JAPAN Location: Harumi Fairgrounds, Tokyo Sponsor and contact: Charles E. Cohrs, General Manager Industrial & Scientific Management Conference 222 W. Adams St., Chicago, Ill. 60606 Frequency: Annual	January 16-19	January

EVENT	1974	1975
JAPAN (continued)		
INTERNATIONAL AUTOMATIC CONTROL EXHIBITION Location: Industrial Center, Tokyo Sponsor: Industrial Daily News, 8-10 Kudan Kita 1-Chome, Chiyoda-Ku, Tokyo, Japan Frequency: Annual	April 5-10	April
JAPAN ELECTRONICS SHOW Location: Tokyo Trade Center Sponsor: Electronic Industry Association of Japan Contact: Shin-ichi Nakajima, Director Chamber of Commerce & Industry Bldg. 14 Marunouchi 3-Chome Chiyoda-Ku Tokyo, Japan Frequency: Annual	September	
ELECTRONICS INDUSTRY PRODUCTION AND TEST EQUIPMENT SHOW Location: U.S. Trade Center, Tokyo		June
JAPAN ELECTRONICS SHOW Location: Osaka Fairgrounds, Osaka Sponsor: Electronic Industry Association of Japan U.S. contact: Exhibit Manager Japan Light Machinery Information Center Electronics Section 437 5th Ave., New York, New York 10016 Frequency: Annual		October
JAPAN ELECTRICAL, ELECTRONIC, MEASURING INSTRUMENT & AUTOMATION EXHIBITION Location: Harumi Trade Center, Tokyo Sponsor: Japan Electrical Measuring Instruments Manufacturers Association Contact: Secretary 20 Shiba Kotohira-cho Minato-ku, Tokyo, Japan Frequency: Biennial		November
KOREA		
14TH NATIONAL GOODS EXHIBITION Location: Seoul Sponsor: The Sanup Kyungje Shinmum 1-12, 3-Ka,-Hoehyun-dong, Choong-ku, Seoul, Korea Frequency: Annual	May	May

EVENT	1974	1975
KOREA (continued)		
5TH KOREAN ELECTRONICS SHOW (Korea Electronics Engineering Seminar held in conjunction with show) Location: Kyongbok Palace, Seoul Sponsor: Korea Fine Instruments Center 222-13 Gueo Dong, Yong Dong, Po, Seoul, Korea U.S. contact: Korea Electronics Industry Information Office Room #2305, 1212 Avenue of the Americas, New York, New York 10036 Frequency: Annual	October	October
NETHERLANDS		
INTERNATIONAL EXHIBITION OF ELECTRONICS—FIRATO Location: Amsterdam Sponsor: RAI Gebouw N.V., Europaplein 8, Amsterdam, Netherlands	August 29-September 8	
INTERNATIONAL INDUSTRIAL ELECTRONICS TRADE FAIR (FIAREX) Location: Rai Building, Amsterdam Sponsor: Stichting Firato Radio Tentoonstelling Johan van der Waalsstraat 8, Amsterdam, Netherlands U.S. contact: Mr. A. J. K. Pelger (address given above) Frequency: Biennial	October 28-November 1	
HET INSTRUMENT (THE INSTRUMENT) Location: RAI Building, Europaplein 8, Amsterdam Sponsor: Het Instrument, Birkstraat 108, P.O. Box 152 Soest, Netherlands U.S. contact: Dr. P. Felix, Birkstraat, P.O. Box 153 Soest, Netherlands Frequency: Biennial		October
POLAND		
POZNAN INTERNATIONAL TECHNICAL FAIR Location: Poznan Fairgrounds, Poznan Sponsor: Poznan International Fair (Miedzynarodowe Targi Poznanskie), Glogowska Street 12, Poznan, Poland U.S. contact: Trade Promotion Division, Office of East-West Trade Development, Bureau of East-West Trade, U.S. Dept. of Commerce, Washington, D.C. 20230 Frequency: Annual	June	June
ROMANIA		
BUCHAREST INTERNATIONAL FAIR Location: Exhibition Pavilion, Bucharest Sponsor: Chamber of Commerce of the Romanian Socialist Republic Frequency: Biennial	October	

EVENT	1974	1975
ROMANIA (continued)		
SPECIALIZED EXHIBITION OF ELECTRONIC MEASURING AND CONTROL INSTRUMENTS FOR INDUSTRIAL AND SCIENTIFIC USE Location: Exhibition Pavilion, Bucharest Sponsor: Publicom, Boul. Balcescu 22, Bucharest, Romania Frequency: Biennial		November
SINGAPORE		
ELECTRONICS ENGINEERING AND MANUFACTURING EQUIPMENT Location: U.S. Trade Center, Singapore	September	
SWEDEN		
STOCKHOLM TECHNICAL FAIR Location: S:T Eriks Mässan, Stockholm Frequency: Annual	October	October
ELECTRONICS PRODUCTION AND TEST EQUIPMENT Location: U.S. Trade Center, Stockholm		January
IM 75—10TH INTERNATIONAL TRADE FAIR FOR INSTRUMENTS AND MEASUREMENTS Location: S:T Eriks Mässan, Stockholm Sponsor: The Swedish Society of Instrumentation Frequency: Triennial		April 21-25
INTERNATIONAL ELECTROTECHNICAL FAIR (ELFACK) Location: Exhibition Hall, Gothenberg Sponsor: Svenska Massan Stiftelse/The Swedish Trade Fair Foundation S-412 51 Göteborg, Sweden Frequency: Biennial		October 20-25
SWITZERLAND		
SAMA INTERNATIONAL—SHOW OF ASSEMBLING MINIATURIZATION AND AUTOMATION Location: Allmend Exhibition Center, Berne Sponsor: SAMA International SA P.O. Box 1052, Ch 2501 Bienne, Switzerland Frequency: Annual	September 23-28	September
SEMINARS AND TECHNICAL MEETINGS OF THE EUROPEAN INSTITUTE OF PRINTED CIRCUITS (EIPC) Location: Various European cities Sponsor: EIPC, Bertastrasse 8, 8003 Zurich, Switzerland Frequency: Several times a year		

EVENT	1974	1975
SWITZERLAND (continued)		
7TH INTERNATIONAL INDUSTRIAL ELECTRONICS EXHIBITION (INEL '75) Location: Swiss Industries Fair, Basel Sponsor: Exhibition Management, Swiss Industries Fair, Ch 4000, Basel, Switzerland 21 U.S. contact: Swiss Embassy 2900 Cathedral Avenue, Washington, D.C. 20008 Frequency: Biennial		September 9-13
4TH INTERNATIONAL SURFACE TREATMENT EXHIBITION (SURFACE) (SURFACE Conference held in conjunction with exhibition) Location: Swiss Industries Fair, Basel Sponsor: Swiss Industries Fair P.O. Box 4021, Basel, Switzerland U.S. contact: Swiss Embassy 2900 Cathedral Avenue, Washington, D.C. 20008 Frequency: Triennial		September 30-October 4
UNITED KINGDOM		
INTERNATIONAL INSTRUMENTS, ELECTRONICS & AUTOMATION EXHIBITION—IEA Location: Olympia, London Contact: Industrial & Trade Fairs Ltd., Commonwealth House New Oxford Street, London, WC1A, England Frequency: Biennial	May 13-17	
LEEDS ELECTRONICS EXHIBITION Location: University of Leeds, England Sponsor and Contact: C. S. Petch, Electrical & Electronics Engineering Department, University of Leeds, Leeds, England LS2 9JT Frequency: Annual	June 25-27	June
INSTITUTE OF ELECTRICAL ELECTRONICS ENGINEERS CONFERENCE —PRECISION ELECTROMAGNETIC MEASUREMENT Location: London Sponsor and Contact: R. A. Soderman, Secretary 1EE Savoy Place London, England Frequency: Biennial	July 1-5	
INTERNEPCON/UK & INTERNATIONAL MICROELECTRONICS EXHIBITION Location: Metropole Convention Centre, Brighton, Sussex Sponsor: Kiver Communications Ltd., 149/155 Ewell Road Surrey, Surbriton, England Frequency: Annual	October 15-17	October

EVENT	1974	1975
UNITED KINGDOM (continued)		
LONDON ELECTRONIC COMPONENTS EXHIBITION Location: Olympia, London Sponsor: Public Relations Officer, Industrial Exhibitions Ltd. Commonwealth House, 1-10 New Oxford Street London, England WC1A 1PB Frequency: Biennial		May
INTERNATIONAL MICROWAVE CONFERENCE & EXHIBITION Location: Metropole Exhibition Hall, Brighton, Sussex Contact: Gordon Saville 51 Victoria Road, Surrey, England Frequency: Annual		June
ENGINEERING INSPECTION CONTROL EXHIBITION & CONFERENCE (INSPEX) Location: Horticultural Hall, London Contact: C. H. L. Venn, Managing Director Business Conferences & Exhibitions Ltd., Mercury House, Waterloo Road, London, England SE 1 8UL Frequency: Biennial		October
YUGOSLAVIA		
ETAN CONFERENCE OF EXPERTS (STRUCNA KONFERENCIJA ETAN-a) Location: Skopje (1974) Sponsor: ETAN (Yugoslav Committee on Electronics, Telecommunications, Automation and Nuclear Sciences) Kneza Milosa 9, 11000 Belgrade, Yugoslavia Frequency: Annual	June	June
ELECTRONICS (EXHIBITION & SYMPOSIA) Location: Gospodarsko razstavisce, Ljubljana Sponsor: (Exhibition): Gospodarsko razstavisce (Ljubljana Fair Authority) Titova cesta 50, P.O. Box 413, 6100 Ljubljana, Yugoslavia Frequency: Annual	October	October

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